

SCIENCE

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ELECTRIC ACCUMULATORS.

THE world moves slowly, — faster, perhaps, than formerly, — but still the movement is well ordered and regular, new things not jumping into existence fully developed and ready for their most advantageous use.

All this is true of the accumulators or storage-batteries for electricity, about which the public has heard for a number of years. The principle on which they are based is an old one. That an electric current, in passing through many chemical solutions, would decompose them, is a fact shown in every school in the land. That

store up its electricity? The answer to these questions is well given in a paper by George B. Prescott, jun., read at a meeting of the American Institute of Electrical Engineers on Oct. 29.

There are in use electrical systems for lighting purposes; and, as every one knows, these are mainly of service after the sun goes down, and then they are called on for a maximum service for a short time, which is followed by a smaller demand during the rest of the night. It is patent that such a method of production cannot be economical, for the plant must be idle, or working to but a fraction of its capacity, most of the time. The accumulator comes in as a storehouse; so that the dynamos may be run at an even

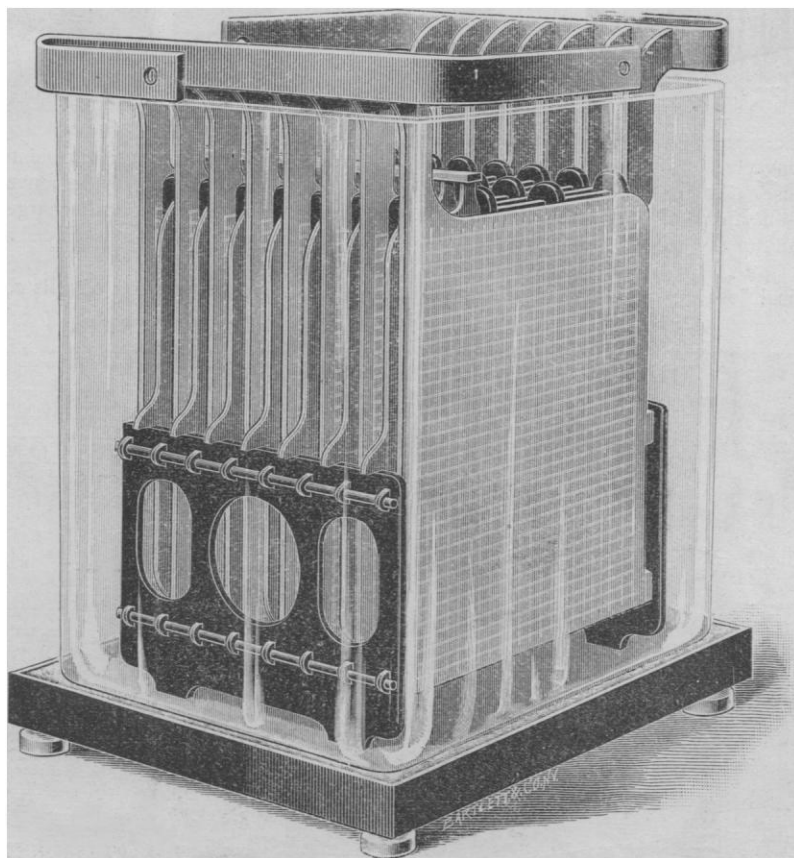


FIG. 1.—ELECTRICAL ACCUMULATOR COMPANY'S STORAGE-BATTERY.

when the battery sending the current is removed, and the wires entering the solution joined, a current can be detected in these wires opposite in direction to the original current, is also known. The decomposing apparatus shows itself as a storage-battery from which, to all intents and purposes, electricity runs out again when the experiment of electrolysis is over. What those interested in storage-batteries have been doing is to make this effect of commercial value.

But why should this effect be of commercial value at all? Why not use the current from the primary battery itself, and not first

rate of production, and any spare electricity stored till the extra demand has to be met.

There is a field, then, in which accumulators may play an important part, not in competition with the direct application of the current from the dynamo, but standing to the electric-light systems very much as gasometers do to gas-works. The demand for light during the day is not *nil*, yet it is so small that few electric-light companies are justified in running their dynamos the twenty-four hours through. But it is calculated that there will be ample surplus of current to charge the necessary storage-batteries if the

dynamos are started at 2 P.M. and work till midnight, — a working day of ten hours, — thus rendering the ordinary electric-light plant efficient the whole day.

There is another field in which accumulators take an active part, — that of long-distance lighting, now so successfully occupied by the alternating converter system, in which the high-potential cur-

rent, is proportional to the number and size of its plates; its rate of discharge depending upon the number of plates and the effective surface of each, while the time of such discharge varies with their thickness. Although there are no obvious theoretical reasons why a single cell of accumulator should not be made sufficiently large to possess any desired capacity, there are mechanical con-

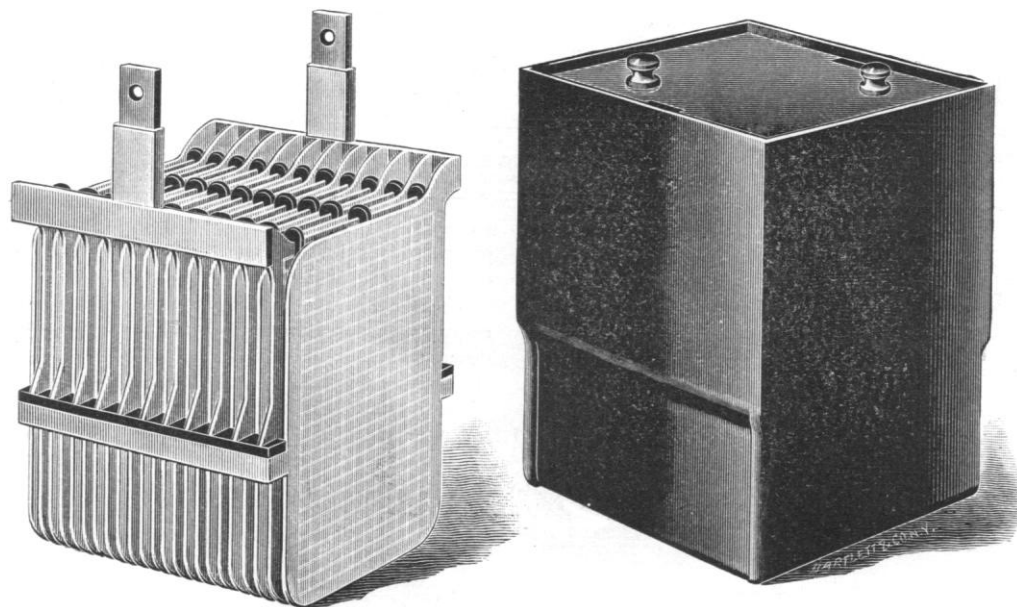


FIG. 2.

rents on the main lines are converted into those of lower potential before entering buildings for use. An accumulator is a chemical converter; and, now that the questions of cost and durability are practically solved, the accumulator is likely to find an application for this converting process.

There is, of course, a practical loss every time energy is trans-

sferred. Considerations which make it advisable to limit the dimensions of a cell to the extent that it may be conveniently portable. Therefore, when higher rates or longer discharges than an ordinary cell will give are demanded, two or more cells must be connected in parallel.

When two or more series of cells connected in parallel are to be

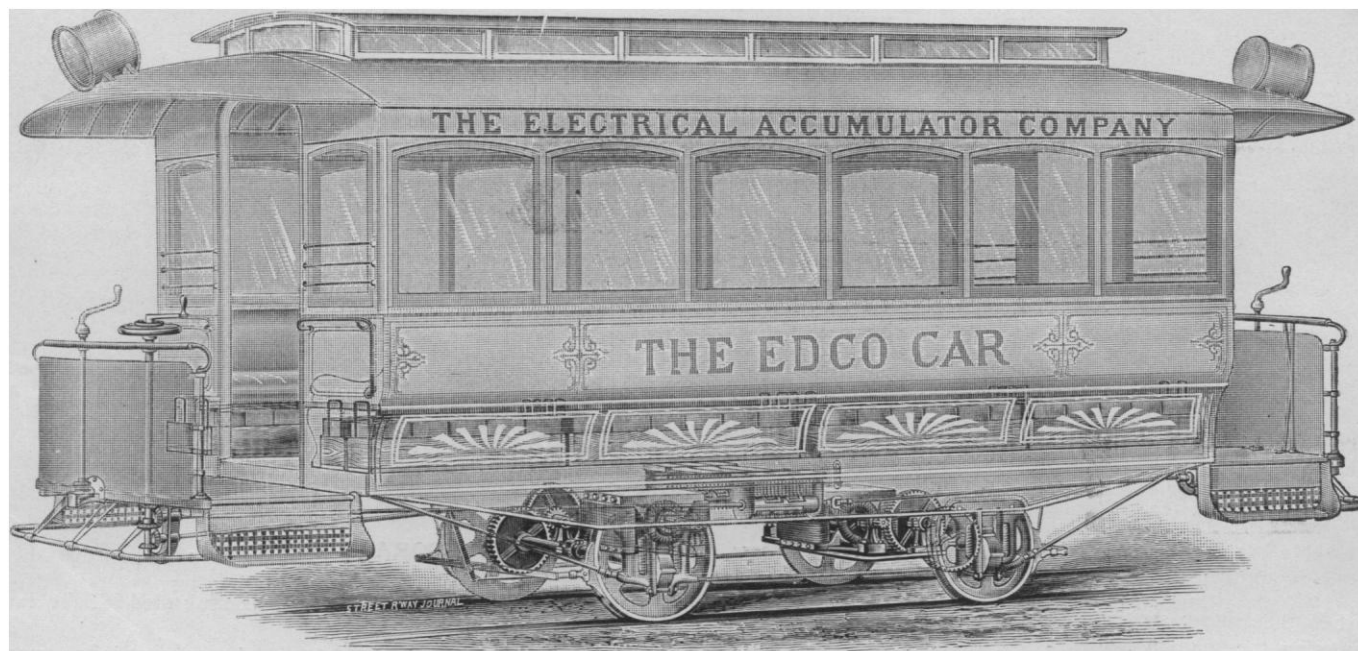


FIG. 3.

formed from one form to another, and this loss is greater the more rapid the rate of charge and discharge of a storage-battery; but this loss, added to the cost of the accumulators, is not believed to be enough to counterbalance the advantages already mentioned.

Generally speaking, the total current capacity, expressed in ampere hours, of a single cell of accumulator of the lead lead-oxide

charged at the same potential, it is evident, that, unless each series is in precisely the same state in respect to residual charge, there will be a difference in their electro-motive forces, and in consequence less current will flow in those series having higher potentials than in others. While the larger current flowing into the less charged cells will have a tendency to bring up their potentials

to the average, it is found in practice that some series will become fully charged sooner than others.

The details of the methods of use we hope to publish later. Our illustrations show the battery and street-car of the Electric Accumulator Company; this car, as is well known, calling for no street wires.

MAGNOLIA-METAL.

FOR the last fifty years the soft metal made of copper, regulus of antimony, and tin, invented by Isaac Babbitt of Boston, and named for him, has been in use for the bearings in machinery, as the friction was much reduced by its use.

posed to be the best of their class. The machine used was a 5-inch shaft keyed on a 3-inch shaft lubricated with sperm-oil, 5-inch shaft running in the oil. With light pressure and slow revolutions of shaft, the metals showed little difference, but, with rapid revolutions and heavy pressures, magnolia-metal showed great superiority. The foregoing table shows a detailed statement of the tests, which occupied an hour's time.

The testing-machine consists of a shaft revolving in suitable bearings, between two of which is a steel journal on which the test-piece is placed; the top half only of the bearing being used, which was lined with the metals tested. The brass sets in a frame, to the under side of which is suspended a platform. On

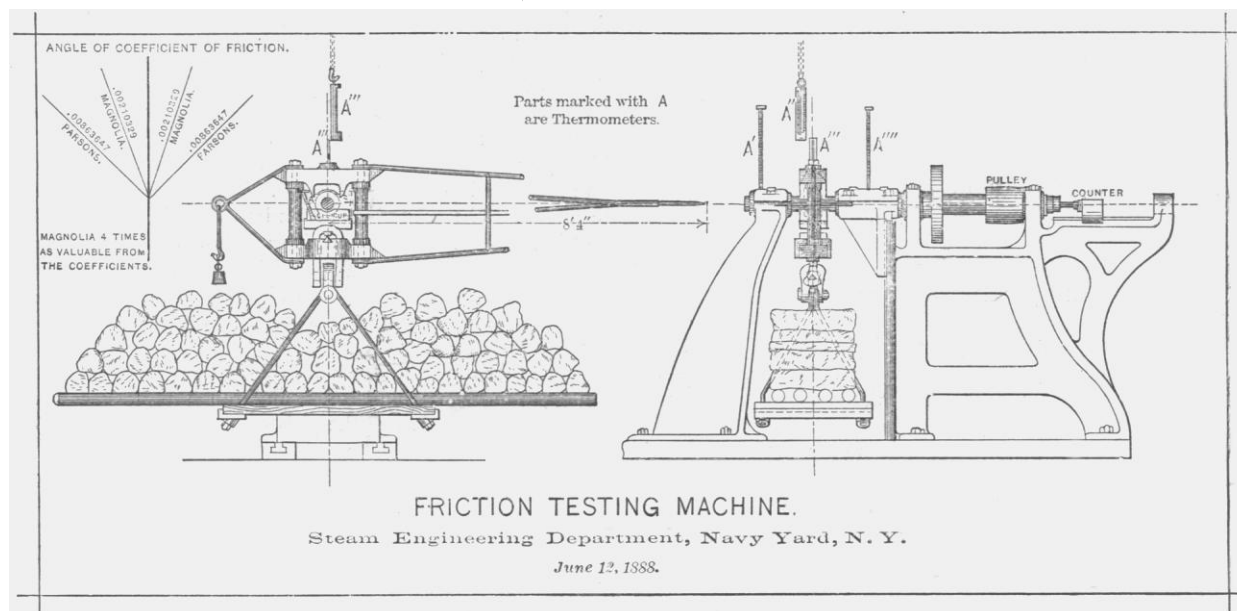


FIG. 1.—APPARATUS USED IN TESTING MAGNOLIA-METAL.

In these days of demand for high speed on railways and in ocean steamers, a diminution of the friction is imperative, and magnolia-metal is offered as furnishing a material for bearings much superior to any thing that has gone before.

Time in Minutes.	Temperature.			Pounds Pressure per Square Inch.	Revolutions of Shaft per Minute.	Speed of Rubbing Surface per Minute.
	Magnolia Anti-Friction Metal.	Hoyt's Genuine Babbitt.	De-Oxidized Genuine Babbitt.			
0	65° F.	90° F.	90° F.	2 gen. Babbs. 200	1,600	2,095 ft.
10	115°	156°	140°	Magnolia 300	1,550	2,030 "
20	150°	180°	170°	300	1,550	2,030 "
30	160°	230°	230°	500	1,500	1,965 "
40	180°	345°	320°	800	1,500	1,965 "
45		397°		1,000	1,500	1,965 "
50	270°		360°	1,000	1,500	1,965 "
55			375°	1,000	1,500	1,965 "
60	400°			1,000	1,500	1,965 "

Magnolia ran full time free without melting out or stopping machinery; Hoyt's melted and stuck to shaft at end of 45 minutes; de-oxidized genuine Babbitt melted and stuck to shaft at end of 55 minutes.

Mr. H. G. Torrey, who has been assayer at the United States Mint, New York, for thirty years, has made several friction tests of journal-bearing metals, the results of which have just been made known. Those selected were magnolia-metal, and Hoyt's genuine Babbitt and the de-oxidized genuine Babbitt, the latter two sup-

this platform the weights are placed for producing the pressure. There are two knife-edges, allowing freedom of the frame, and the weighted platform. A pan beneath the test journal, carrying oil, lubricated the bearing. Thermometers were inserted in the oil-bath and in a recess in the top of the metal. In this machine the co-efficient of friction is obtained by the angle of deviation of the knife-edge from a vertical line passing through the centre of the journal in terms of the radius of the journal, and is independent of the weight entering directly into this calculation.

Other satisfactory tests have been made by the United States Government at the Brooklyn Navy Yard, and by Professor R. H.

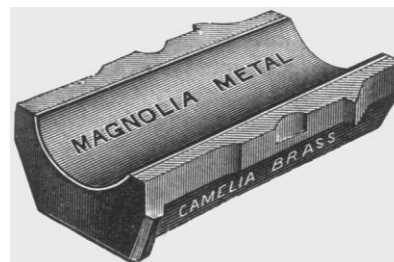


FIG. 2.—MAGNOLIA-METAL BEARING.

Smith of Mason College, Birmingham, England, who reports that his tests show the metal to be superior to either Babbitt or gun-metal, producing less friction, keeping the bearing temperature lower, requiring less lubrication, and possessing greater durability. Professor Smith says that the longer the magnolia-metal bearing is used, and the more severe the duty imposed on it, the better becomes its condition.

Recently this new metal has been introduced in the "City of Paris" and the "Augusta Victoria," contributing its share in the speed developed by these ocean racers.

ATMOSPHERIC NITROGEN AS PLANT-FOOD.

FARMERS in all older portions of the country buy large quantities of nitrogen in artificial fertilizers. Nitrate of soda, sulphate of ammonia, dried blood, cottonseed-meal, and fish-scrap owe their fertilizing value mainly, and Peruvian guano and tankage largely, to nitrogen; and the same element is one of the chief ingredients of bone manures, ammoniated phosphates, and many other fertilizers. According to an estimate by the Connecticut Experiment Station, not less than five hundred thousand dollars are expended annually for commercial fertilizers in Connecticut. A large amount of this goes for nitrogen, which is one of the dearest of the ingredients of fertilizers, and costs at retail from eight or ten to eighteen cents or more a pound.

The Storrs School Agricultural Experiment Station, Mansfield, Conn., in its October bulletin, reports a continuation of an investigation of atmospheric nitrogen as plant-food, begun some years ago at Wesleyan University, Middletown, where the chemical work of the station has been carried on since the establishment of the latter in 1888. The details of the experiments there reported were conducted by Mr. C. D. Woods, formerly assistant in chemistry in Wesleyan University, and now chemist of the station.

The quantities of nitrogen in ordinary crops, and the cost of the same in the better commercial fertilizers, vary from 31.5 pounds for potatoes, to 80.3 pounds for clover-hay, costing from \$4.73 to \$12.05.

The plants must have this nitrogen, or they cannot grow. They obtain part of it from the soil, and the rest from the air. The nitrogen of the soil has either been accumulated in the past or is supplied in manures. A small quantity, in the form of ammonia and other compounds of nitrogen, is continually brought to the soil by rain or snow. Late research implies that soils acquire nitrogen from the air by the aid of microbes or electricity, or probably both. The nitrogen in the soil is being continually leached away by drainage-waters, and more or less of it escapes into the air. Soils which are not cultivated, and from which the produce is not removed, accumulate more nitrogen than they lose, so that many virgin soils have a large stock. By ordinary cultivation and cropping, the nitrogen is gradually exhausted, unless it is returned by manures or otherwise.

The main questions have been, first, Can plants make use of atmospheric nitrogen to any considerable extent? second, If they do, is it the free nitrogen of the air that they acquire? There are certain kinds of plants, like clover, beans, and others belonging to the family of the legumes or *Papilionaceæ*, which generally get on very well without nitrogenous fertilizers in worn-out soils; and it would seem as though these plants, at any rate, must in some way be able to make use of the nitrogen of the air. But the classic experiments of Boussingault in France, of Lawes and Gilbert in England, and others, have been widely accepted as proving that plants cannot use the free nitrogen of the air, and that they get practically very little combined nitrogen from the air, so that they are dependent upon that previously stored in the soil or supplied in manures. Still many experimenters have not regarded the question as definitely settled.

While the experiments of Boussingault, and Lawes and Gilbert, differ in their details, they agree in this, that the plants were under conditions widely different from those in ordinary culture. The especial object was to find whether plants acquire free nitrogen; and the plants were for the most part grown under cover, to exclude combined nitrogen, and in artificial soil containing little or no nitrogen. The growth was generally stunted and abnormal.

Later experiments on more or less similar plans have brought similar results. Investigations by Ville in France, however, implied that plants can acquire nitrogen from the air, but his conclusions were not generally accepted.

Some years ago a series of experiments was conducted by Mr. C. D. Woods, in which the conditions were more like those in which plants commonly grow. The method used was that of sand-culture. By proper management, feeding, and watering, plants may be grown as large, as healthy, and in every way as well developed, in pure sand as in the richest soil. For these experiments sea-sand was used. To remove all traces of material containing nitrogen

(except, of course, air), the sand was carefully sifted, then washed, and finally heated in iron pots in a furnace, so hot that the pots nearly melted. It was then put in glass jars, and water was added in which were dissolved salts containing the mineral elements of plant-food, potash, lime, iron, sulphuric acid, phosphoric acid, etc., and in some cases nitrogen in the form of nitrate of potash or lime. The seeds were then sown, and the plants grew. They were kept in the open air in a building erected for the purpose. The arrangement was such that the plants were exposed in the day-time in pleasant weather, but put under cover when it rained and at night. They had enough plant-food to enable them to make more or less growth independently of the nitrogen of the air, but were free to get the nitrogen from the air in case they were able to do so. They grew well. Many of them were as well or better developed than those in a rich garden-soil near by.

The amount of nitrogen in the seeds and in the nutritive solutions was determined by analyses at the beginning of the experiments. The same was done with the nitrogen in the plants at the end of the experiments, and with that left in the nutritive solutions. The quantities of nitrogen supplied to the plants at the beginning, and contained in them at the end, of the experiment were thus determined. The plants were found to contain more nitrogen than had been supplied by the nutritive solutions and the seeds. For this gain there was but one possible source, the atmosphere. The peas had in some way acquired nitrogen from the air, and in some cases the quantities of atmospheric nitrogen thus obtained were very large.

Since that time a number of investigators have obtained similar and even more striking results, and much light has been thrown upon the ways by which the plants are enabled to obtain the nitrogen from the air.

Professor Hellriegel in Germany has found from a large number of experiments that pea, lupine, and serradella plants obtain large quantities of nitrogen from the air, while oats, barley, and buckwheat seem to be restricted to that supplied to them in the soil and obtained through the roots. He has furthermore brought out the very important fact that there is a connection between the nitrogen acquired and the tubercles which are found on the roots of leguminous plants. The root-tubercles are the bulb-like enlargements, from the size of a pin-head to that of a pea or larger, sometimes called "warts," which are found on the roots of beans, peas, clover, cow-peas, and other leguminous plants. They are often thought by persons not botanists to be indications of disease. This suggests that minute organisms, termed "microbes," which are in some way connected with these tubercles, may be the agents by which the plants obtain nitrogen from the air.

To test the influence of the microbes in the soil, Professor Hellriegel prepared soil-infusions by putting small quantities of soil in water, shaking the mixture thoroughly, and letting it settle. The water was then assumed to contain the microbes. The infusions thus prepared were put into the sand in which the plants grew. In a very remarkable series of trials it was found that where leguminous plants were supplied with mineral but no nitrogenous food, and received these infusions, they grew well, had tubercles upon their roots, and contained large quantities of nitrogen when mature. Those which received no infusions, or infusions which had been sterilized, i.e., in which the microbes had been killed, made very little growth, had few or no tubercles, and showed no gain of nitrogen. In another experiment Professor Hellriegel grew peas and buckwheat inside a large glass globe, as Boussingault had done, except that soil-infusions were added. In both Hellriegel's and Boussingault's experiments the plants had practically no nitrogen except that in the seed and the free nitrogen of the air. Boussingault's plants made very little growth, and showed no gain of nitrogen. The same was true of Hellriegel's buckwheat; but his peas grew well, and gained considerable nitrogen. In other words, where the microbes were present, the peas evidently utilized the free nitrogen of the air.

Professor Wolff in Germany has reported experiments with clover which imply acquisition of atmospheric nitrogen. Numerous other late experiments indicate that both plants and soil obtain nitrogen from the air.

The experiments now described in this bulletin may be divided

into the following series: 1888, Champion of England peas, 25 trials; 1888-89, alfalfa, 5; 1889, East Hartford Early peas, first series, 33; 1889, Champion of England peas, 16; 1889, oats, 10. Other series with other plants are begun, but are not yet ready to be reported upon. The following questions were proposed for study: 1. May plants grown under normal conditions acquire any considerable amount of nitrogen, free or combined, from the surrounding atmosphere? 2. What effect has the addition of soil-infusions upon the formation of root-tubercles? 3. Is there a definite relation between the formation of root-tubercles and the acquisition of atmospheric nitrogen?

The method was essentially the same as in the previous experiments by Mr. Wood above described. The plants were grown in glass jars containing sand, purified by washing and igniting. Nutritive solutions, either free from or containing known quantities of combined nitrogen in the form of nitrate of potash or lime, were applied to the sand. The amounts of nitrogen supplied in nutritive solutions and seed were compared with the amounts found at the end of the experiments in residual solutions and plants. The difference between these two amounts must show the loss or gain in nitrogen. A loss must indicate decomposition of either the organic nitrogen of the seed or plants or the nitric acid of the nitrates fed, or both. A gain must represent the nitrogen acquired from the air in excess of any lost either from organic matter of seed or plant or from nitrate of the food.

The conditions of growth were varied by varying the amounts of nitrogen supplied in nutritive solutions. The minerals needed for the growth of the plants were added in amounts to make one part or less by weight of dissolved salts in one thousand parts of the solution. Some of the plants received no combined nitrogen except that in the seed; to others nitrates were added, but in such small quantities that the minerals were relatively in excess; to others enough nitrogen was added to make the mixture of plant-food correspond more nearly to the composition of the plants.

The answer to the question, "May plants grown under normal conditions acquire any considerable amount of nitrogen from the atmosphere?" coincides with the earlier experiments at Mansfield, and is plain and unmistakable. Peas of small, early variety (Early Hartford) planted in sand, with no nitrogenous food except that in the seed, grew to a height of over five feet. With nitrogen supplied in the solutions, they sometimes reached a height of over eight feet. Many of the peas and alfalfa plants accumulated large quantities of nitrogen from the air. In one case a single plant thus obtained more than one-third of a gram (54.6 grains) of nitrogen.

In a number of experiments with peas in which the roots had few or no tubercles, instead of gain, there was a decided loss of nitrogen. This gives added force to the suggestion that if nitrogen escaped in some of the trials, it may have escaped to some extent in other cases also. If so, the results are all inaccurate as indications of the actual atmospheric nitrogen acquired, and the plants must have really obtained more than the figures imply.

It may be that the loss of nitrogen is greater in some classes of plants than in others. The apparent loss in the experiments with peas was about as large when they were not fed combined nitrogen, other than that in the seed, as when they were fed considerable quantities of nitrates. In the experiment with oats the results were very different. Without the addition of nitrates, there was no loss, but a slight gain. When nitrates were fed, there was loss; and the larger the amount of nitrates added, the greater was the loss of nitrogen.

These experiments do not tell to what extent the loss observed with the oats, and with the peas which had no root-tubercles, was from the seed, and to what extent from the nitrates; whether, as seems most likely, it was due to the action of microbes; or what connection there may be between plants of different species and the loss of nitrogen. These and kindred questions must remain for future research to decide. But one can hardly help coupling this observation of the large loss of nitrogen in the oat experiments with the common observation of practical farmers that oats are an exhaustive crop. The power of leguminous plants to acquire nitrogen from the air evidently explains in part why they are such valuable "renovating crops."

Experiments by Berthelot and others imply that nitrogen is being continually gathered from the air by soils, and that microbes, and probably electricity, aid the process. A large amount of late research tends to show that nitrogen compounds in the soil are being constantly decomposed by the action of microbes, and that the nitrogen thus set free escapes into the air.

In Hellriegel's experiments the development of the root-tubercles on the plants seemed to be dependent upon the addition of soil-infusions: in those of the Storrs School Station, although the sand and water were sterilized, root-tubercles were often abundant where no soil-infusions were added. This was especially the case where the plants had some nitrogenous food. Indeed, where the plants were reasonably well fed, so far as the root-tubercles were concerned, it made no apparent difference whether they had soil-infusions or not; nor was there much difference where the plants had no nitrogen in their food. The plants were grown near a garden in which the soil was rich; and the microbes, which seem to be connected with the root-tubercles, were probably abundant. The most natural explanation is, that the organisms or their germs (spores) were floating in the air; found their way to the pots in which the plants were cultivated, and grew there; and that the growth of the microbes was especially favored where the plants had nitrates, i.e., had food enough to keep them vigorous until the tubercles were formed.

These experiments, like those of Hellriegel, reveal a remarkable relation between root-tubercles and the acquisition of nitrogen from the air by plants. Leguminous plants thus far experimented with have root-tubercles, and acquire atmospheric nitrogen. Other plants have been found to be without root-tubercles, and to gain little or no nitrogen; while in some experiments, as in those with oats, above cited, there is a large loss. There is an evident connection between root-tubercles and microbes, though the exact nature of the microbes and their connection with the tubercles remain to be explained.

While there is as yet no positive proof that the root-tubercles or the microbes are the cause of the gain of nitrogen, the fact that there is a connection between the root-tubercles and the amount of nitrogen acquired by the plants from the air is unmistakable. In every case, without exception, where there were no root-tubercles, there was loss of nitrogen; where there were "few" tubercles, there was sometimes a slight loss of nitrogen, at other times a slight gain; with a "fair number" of tubercles, there was a decided gain; where there was a "large number" of tubercles, the gain of nitrogen was very large.

It may be that this relation holds in fields as well as in pot-culture. The past season the station grew a half-acre of cow-peas, which yielded at the rate of about eight tons of green fodder per acre. In some ten different places in the field the roots were examined, and found to be covered with tubercles of large size. At one end of the field, where the yield was relatively light, the roots had less tubercles than elsewhere, and in general where the growth was heaviest the tubercles seemed to be most abundant.

As to whether the nitrogen which the plants obtain is the free or the combined nitrogen of the air, these experiments do not bring absolute proof, but the quantities of nitrogen obtained are so very large as to leave little doubt that it is free nitrogen; and the experiments of Hellriegel above cited would seem to prove that the uncombined nitrogen can thus be used. This and the cognate question as to how the nitrogen is acquired, demand further study. Investigations in this line are being planned for at the station.

This subject has a wider significance than what has been said above implies. The future welfare of our race, material, intellectual, and moral, depends upon the food-supply, or, in other words, upon the product of the soil. This, in turn, reduces itself essentially to a question of phosphoric acid, potash, and nitrogen. Enough of the first two for indefinite time to come is assured in the deposits of phosphates and potash salts already discovered, but the probability of a sufficient supply of nitrogen has been questioned. This costliest of the fertilizing elements escapes from our soils into the air and into the sea, and is taken away by crops, and not completely returned. Artificial fertilizers promise to meet but

a small fraction of the coming demand. If, as has been urged, the exhaustless stores of the atmosphere are not available to plants, the outlook is dark enough; but if the farmer may use his crops to gather it, without money and without price, we may dismiss our solicitude. With the assurance that plants obtain nitrogen from the air, the fear of starvation for the over-populated earth of the future may be ignored. That research is bringing the brighter answer to this problem, there seems to be most excellent ground to hope.

WARM AND COLD WATER FOR MILCH COWS IN WINTER.

WHETHER or not it is desirable in Wisconsin to warm water for domestic animals, has been experimented upon by F. H. King at the Agricultural Experiment Station at Madison.

On the night of Jan. 21, 1889, six cows were placed in stanchions side by side, in two groups of three each, upon a daily ration of five pounds of bran mixed with two pounds of ground oats and six pounds of hay, together with what dry cut corn-fodder they would eat up clean; and this ration was not changed until after the close of the experiment, March 25. During this time the cows were fed twice and watered once daily. They were allowed the freedom of the barnyard during the middle of each pleasant day, and in every way received similar treatment, except that, when one group of cows was getting water at 32° F., the other group took it at 70° F. The time of the experiment was divided into three periods of sixteen days each, having intervals between them. At the close of the first and second periods the temperatures of the water were reversed for each of the cows in order to eliminate, so far as might be, the individual differences of the two groups.

In plan this experiment contemplated as its chief object ascertaining whether it is true, as many farmers believe, that warm water for milch cows produces a measurable increase in the yield of milk over that of cold water, and, if so, whether this increase affected the volume simply, or the weight of the solids contained, to an extent which would make it remunerative in general practice to warm the water for cows.

The discussion of the results obtained has shown for these six cows, while under experiment, the following facts:—

1. While on warm water, they gave, on the average, 1.002 pounds of milk per cow per day more than while on cold water, or 6.23 per cent of the general average daily yield of 16.06 pounds.
2. They drank on the average, daily, while on cold water, 63 pounds; but while on warm, 73 pounds, or 10 pounds per cow more.
3. They ate more while on warm water than while on cold, and at the rate of .74 of a pound of corn-fodder per cow per day.
4. An increase in the amount of water drank was coincident with an increase in the quantity of milk given; and this was true irrespective of whether the water was warm or cold, an increase of 10 pounds in every 100 pounds of water drank being accompanied by an increase of 1 pound in every 100 pounds of milk given, nearly.
5. They consumed solid food, while on warm water, at the rate of 1.44 pounds for each pound of milk produced; and while on cold water, at the rate of 1.54 pounds for each pound of milk given.
6. An increase in the amount of water drank, when the temperature of the water remained the same, was associated with an increase in the amount of water in the milk without a notable increase in the total solids contained.
7. An increase in the temperature of the water drank, rather than an increase in the quantity of it, was associated with an increase in the total amount of solids produced.
8. There was a daily fluctuation in the percentage of water in the milk associated with a fluctuation in the amount of water drank.
9. Five cows manifested a strong preference for water at 70° over that of 32°, but one of the cows showed an even stronger liking for the iced water.
10. With but one exception, the cows, while they ate less and drank less during the cold-water periods, weighed more at their

close, and, with but three exceptions, they weighed less at the close of the warm-water periods.

11. With butter at 20 cents per pound, skimmed milk at 25 cents per hundredweight, corn-fodder at \$5 per ton, and the cost of warming water for forty cows 120 days at \$15, the results obtained from the cows on the experiment indicate that a net gain of \$21.36 would be realized on a herd of forty cows averaging sixteen pounds of milk per cow per day, and at least \$10 on a herd of twenty, and \$5 on a herd of ten cows. Counting corn-fodder at \$10 per ton, the net gain on a herd of forty cows would still be \$12.48.

THE ETHNOLOGICAL SIGNIFICANCE OF THE BEECH.

THE new science of linguistic paleontology has thrown a flood of light on several obscure problems of ethnology. It has, for instance, been proved that the names of the ass and the camel in Aryan languages are not primitive, but merely loan-words from the Semitic. This fact by itself goes far to disprove the hypothesis which placed the cradle of the Aryans in Central Asia, a region of which these animals are natives.

According to an article on the above subject by Canon Isaac Taylor, published in a recent number of *Knowledge*, in no case have more valuable results been obtained than in the case of the beech. This tree, which flourishes only in temperate climates, and is a lover of chalk subsoils, is confined to a definite and restricted area. It grows in the extreme south of Norway and Sweden, but is not found east of a line which strikes across Europe from the Frische Haff on the Baltic coast, near Königsberg, through Poland to the Crimea, ending finally in the Caucasus.

In former times the limit was more narrowly restricted. In Cæsar's time the beech had not reached Britain or Holland, while at the close of the bronze age, or the beginning of the iron age, it was only just beginning to replace the oak in Denmark. Early in the neolithic age its range was probably confined to France, northern Italy, and northern Greece; while in Germany, as Dr. Schrader believes, it did not extend north of the Thuringian forest. It flourishes in Macedonia, and clothes the north-eastern slopes of the Thessalian coast chain, while in the south of Epirus the ilex or evergreen oak replaces it as the characteristic forest-tree.

Within these ancient limits of the beech we must place the cradle of four Aryan languages,—German, Latin, Celtic, and Greek. We draw this conclusion from the following philological facts: the word for beech is, in Gothic, *boka*; in Latin, *fagus*; in Celtic, *faidhbhile*; while the corresponding word, *φῆγος*, denotes the oak in Greek.

With regard to other members of the Aryan family, the names for the beech—*buky* in old Slavonic, *bukas* in Lithuanian, and *buk* in Russian—are manifestly loan-words from the German. This would go to prove that the Slavs, in the prehistoric period, must have dwelt east of the beech line, though they have since advanced within it. Johannes Schmidt has shown reason for believing in the unbroken geographical continuity of the European Aryans, previous to the linguistic separation: hence they must be placed astride, so to speak, of the beech line,—the Slavs and Lithuanians in European Russia; and the Celts, Latins, Hellenes, and Teutons, farther to the west.

We have now to account for the fact that the word denoting the beech in Latin, German, and Celtic, has come in Greek to denote, not the beech, but the oak. A well-known explanation of the difficulty has been offered by Professor Max Müller in the second series of his lectures. He contends that the word originally denoted the oak, but that it was transferred to the beech at the time when the oak-forests of Jutland were replaced by beech-forests. But this does not account for the fact that the Latin word *fagus* means the beech, for Helbig has shown that the Umbrians had already reached Italy before the commencement of the age of bronze. The bronze age began in Italy earlier than in Denmark, and in the bronze age the oak was still the prevailing tree in Denmark, and was quite unknown in the neolithic age, when the Umbrians, whose language was a dialect of Latin, were already settled in Italy. The word *fagus*, therefore, must have denoted the beech in Latin at a period prior to the change in the forest-growth to

which Professor Max Müller attributes the alteration in the meaning of the word.

Moreover, a great change in the vegetation of a country, such as the replacement of the Danish oak-forests by forests of beech, must have occupied many centuries. At what moment, then, was the name transferred from one tree to the other? Were the people of Denmark content to have no name for the beech when it first appeared, and what did they call the oak after having deprived it of its original title, in the prolonged period during which the two trees must have been growing side by side?

Another hypothesis, less beset with difficulties, has been advanced by Geiger and Fick, who suppose that the word originally signified the beech, and received among the Greeks the changed signification of the oak. If the Greeks had migrated from a land of beeches to a land of oaks, there is no difficulty in understanding that they may have transferred the name of one tree to the other. The word meaning the food-tree (*φαγῖν*, "to eat") would be as applicable to the evergreen oak, with its acorns, as to the beech, the mast of which was the staple food for their swine. The beech, as has been said, is not found south of Dodona, which lies in the centre of Epirus. It is noticeable that the most ancient Greek legends are connected with Dodona, where the Greeks made their first halt in their progress to the south, and where the earliest prophetic utterances were obtained from the rustling of the leaves of the sacred tree, — the *φηγὸς*. Hence we may believe that the Greeks entered the peninsula, not from Asia Minor, but from the north-west, through the valleys of Epirus. This route would explain how the old Aryan word denoting the beech came to be applied by the immigrants to designate the tree which flourished on the hillslopes of their new territory. In modern times we have similar instances of transferred names in the United States, where such English names as "the robin," "the hemlock," and "the maple" are used to denote wholly different species.

But with regard to the Greeks, it may be urged that before they entered the peninsula they must have been already acquainted with the deciduous oak which flourishes in the region whence they emigrated. This objection is met by the fact that the Greeks had a second name for the oak, *δρῦς*, which corresponds to the old Irish *daur* oak, as well as to the Gothic *triu*, and the Sanscrit *dru*, which mean simply a tree. Both of the Greek words for the oak are used by Sophocles in speaking of the sacred oak at Dodona.

The Greek word for the deciduous oak agrees with the Celtic word, while the Greek word for the evergreen oak was the word which in their former home had denoted the beech.

The question as to whether the original Aryan word denoted the beech or the oak is not unimportant, as from it may be drawn an inference as to the primitive seat of the Aryan race.

According to Professor Max Müller, the Aryans migrated from Central Asia, where the beech is unknown. If this had been the case, it is extremely difficult to explain how the ancestors of the Latins, Celts, and Teutons, migrating, as Pictet maintains, at different times and by different routes, to lands where the beech abounds, should all have chanced to call it by the same primitive name, merely modified according to the fundamental phonetic laws of Latin and German. But, on the other hand, all such difficulties disappear if we assume that the cradle of the Aryans was in the original beech region; that is, roughly speaking, in the valleys of the Rhine, the Main, and the Danube; and that it was here that the differentiation of the Greek, Latin, Celtic, and German languages took place.

The name of the beech bears also on the solution of the question as to which of the neolithic races has the best claim to represent the primitive Aryans. The choice probably lies between the brachycephalic Celto-Latin race, some of whose earliest settlements may be discovered in the pile-dwellings of Bavaria, Switzerland, and northern Italy, and the dolichocephalic Scandinavian race, whose remains are found in the Danish kitchen-middens. That one of these races constituted the primitive Aryan race, and imposed its language on the other, is highly probable.

Now, as we have already seen, in the neolithic age the beech had not yet reached Denmark, the fir being at that time the predominant tree. In the bronze age the fir was succeeded by the oak, which gave place in the iron period to the beech: hence the beech

region was at that time inhabited by the Celto-Latin people, while the Scandinavian race in all probability dwelt to the north of its limit.

The beech has therefore a threefold ethnological significance. 1. It proves that the Greeks entered Hellas from the north, probably through Epirus, and not, as has been contended, from Asia Minor. 2. It proves that the differentiation of the Aryan languages took place not in Asia, but in Central Europe, on either side of the beech line; the Slavs and Lithuanians being to the east of it, the Greeks, Celts, and Latins, farther to the west. 3. It makes it probable that the primitive Aryans belonged to the brachycephalic Celto-Latin race, and not the dolichocephalic Scandinavians.

ENGLAND'S COAL-RESOURCES.

A PAPER on this subject was read by Professor Edward Hull at the recent meeting of the British Association. To at once set at rest any alarm that may be felt as to Professor Hull unfurling the old banner of "Exhaustion of English Coal-Fields," *Engineering* states that he estimates there is enough coal in Northumberland and Durham to last, at the present rate of consumption, for three hundred years; supposing, of course, one goes deep enough for it. Before that period has elapsed, however, it is to be hoped, on behalf of posterity, that the petroleum-engine, the sun-motor, or some other force, will have promoted steam and gas engines to the serener atmosphere of the antiquarian museum.

Professor Hull is the director of the Geological Survey in Ireland, and he naturally turns to coal as a refreshing subject, which has not become hackneyed to him by his official labors. By a diagram shown on the walls, the output of coal since the beginning of the century was given. The figures have often been quoted, but may be given once again in brief. In the year 1800 the output of coal probably did not exceed 10,000,000 tons, a very large proportion of which was drawn from the Newcastle district. In the year 1830 the quantity raised in the British Islands was about 29,000,000 tons, in 1860 it had reached 80,042,698, and in 1888 the quantity had reached about 170,000,000 tons, as shown by the returns issued by the Board of Trade. There was reason for believing that between the beginning of the century and the year 1875 the output of coal had more than doubled itself for each successive quarter of a century. Since the year 1860, in which the author had estimated that sufficient coal existed to a limiting depth of 4,000 feet to last, at the rate of production for that year, for one thousand years, the available quantity of coal had been reduced by 3,650,000,000 tons; but this amount, great as it was, had not very materially affected the coal-resources. The production of the South Wales coal-field had doubled in the quarter of a century between 1854 and 1879, and in 1888 amounted to the enormous total of 27,355,000 tons, largely owing to the demand for steam-coal in the Cardiff district. The resources of this great basin are enormous, and render it capable of maintaining or increasing its present output for a long period of years. The Lancashire and Cheshire and the great Yorkshire and Nottingham coal-fields are highly progressive, as is also the Northumberland and Durham. This great northern coal-field, notwithstanding the long period over which it has been worked, shows no signs of falling off in its output. The discovery of the liassic ironstone of the Cleveland district, and the great exports from the northern ports, have given a vast impetus to northern coal-mining during the last quarter of a century; and the enormous drain upon this coal-field, the limits of which have been definitely determined, cannot fail to cause a serious falling-off in its output during the twentieth century, although there is sufficient to maintain the present rate of consumption for three hundred years. The relation between coal-production and the development of the iron trade since the discovery of the ironstone deposits of the North Riding of Yorkshire, and the richer hematites of North Lancashire and Cumberland, was then considered; and the different coal-fields of the British Isles were passed in review in order to show those which are in a progressive condition, and which are stationary or retrogressive. The author concluded his subject by expressing an opinion, that, while the enormous output of coal during the past few years had not actually crippled England's resources, a general rise in the value of coal must ensue in the near future, owing to

the greater depth at which the mines will have to be worked, and the increased cost of coal-mining. Reference was then made to the great expansion of coal-mining in America, and the author agreed with the late Professor Jevons that future British manufacturers must not expect to derive any help from the import of coal from the United States when coal shall have become dear or scarce at home.

A good discussion followed the reading of this paper. Mr. Bourne pointed out that the opening of the Canadian route to the East would ease the demand on English product, as coal had been discovered in the Dominion. Thus the Peninsular and Oriental ships, instead of filling with English coal at foreign stations, would probably be running from Vancouver to China and Japan, and use Canadian coal. The speaker looked to petroleum to lessen the demand for coal in many instances, as it had already done in many cases. He did not consider the electric light had done much in this direction, but, if water-power could be more largely used, some relief might be hoped for in that direction.

Mr. G. W. Hastings, M.P., spoke on the aspect of the question from the political economist's standpoint, and pointed out that coal-owners had been making very little profit from their exports.

Mr. John Marley, president of the Northern Institute of Mining and Mechanical Engineers (Darlington), said it would be well if Professor Hull had taken into consideration one or two facts in connection with the coal-trade. One was that thirty years ago the amount of coal required for the production of every ton of pig-iron and its detailed manufacture was double the quantity it is now. That would, therefore, form an element in future calculations. Also the manufacture of steel only required about half the number of tons of coal which was required for each ton of manufactured iron. Another point which the professor had named was his differing from the Royal Coal Commission in not taking into account the coal-seams between 12 inches and 24 inches in thickness. The professor evidently thought that these seams will not come into play so much as he (Mr. Marley) would venture to submit they will, on account of the great depth to which shafts will have to be sunk to work them. He would call Professor Hull's attention to the fact that these shafts have to be sunk, and are sunk, to the thicker seams; and when these thicker seams are exhausted, then the thin seams, between 1 foot and 2 feet in thickness, come into play. He spoke of what was an actual fact, for he knew many instances where seams of 14, 16, and 18 inches were at this moment being worked profitably in the county of Durham from shafts sunk from the thicker seams. Professor Hull would therefore see that his objection to the expensive shafts for these thin seams did not really apply.

Professor Hull, in reply, did not anticipate that petroleum, however largely it was likely to come into use in England, would make very much difference in the demand for coal. As to Mr. Marley's remarks on the greater economy of fuel in the manufacture of iron, he himself could remember when eight tons of coal were required in the Midlands for the production of one ton of iron, while now only $1\frac{1}{4}$ tons of coke were required in Cleveland per ton of pig-iron. At the same time, the economy in the use of coal was more than counterbalanced by the enormous increase in the production of iron.

HEALTH MATTERS.

Insanity following Surgical Operations.

IN a recent letter to the *British Medical Journal*, Dr. Tait writes, —

"I have now performed, so far as I can estimate, between seven thousand and eight thousand operations requiring the use of anæsthetics, and I have had anæsthetics administered in my practice for purposes not involving traumatism probably in three thousand more instances, and I know of seven cases of sequent — not necessarily consequent — insanity. Of course, there may have been others not known to me, and I shall say fourteen cases to cover that margin of error. My own practice, therefore, does not yield a proportion of cases of insanity following operations larger than the general proportion of insanity in the adult female population; and,

if I include the cases of anæsthesia, it is probably considerably smaller.

"Dr. Denis, in his book on this subject, says, 'En moyenne, on observe 2.5 cas d'aliénation mentale sur 100 opérations.' But if this had been the case, all of us engaged in active operating practice would have felt the influence of the fact long ago. Personally I have been struck by the occurrence of insanity after operations as being like the occurrence of tetanus, — something to be met with occasionally, but not a matter to calculate upon. If I saw an insanity rate of 2.5 in my operations, it would be more striking than any death-rate in every thing but my hysterectomies, and in that class I have already said I have never seen insanity follow in a single instance; and Dr. Bantock's experience amounts to practically the same result, for his exception cannot really be called one of insanity following an operation. As a *per contra*, I can point to at least thirteen cases where operations have cured insanity."

TRANSPLANTATION OF SKIN FROM A CORPSE TO A LIVING PERSON. — Dr. Bartens has successfully transplanted the skin of a corpse to a living person who had been severely burned. His method of procedure, as described in the *Brooklyn Medical Journal*, was as follows: On Dec. 13 a lunatic died in the hospital of pyæmia following a compound fracture of the arm, and about twenty minutes after his death two large, good-conditioned flaps were removed from the legs of the corpse. These were laid in warm water to which a little salt had been added, and then were taken to the division of the hospital (two or three hundred yards away) in which the scalded boy lay. These flaps were then carefully washed, and cleansed of their subjacent fatty pannus; that done, they were divided into smaller pieces of from one centimetre wide to about one to two centimetres long (the ulcerated surfaces of the boy's legs had been cleansed in the same manner as the flaps in the mean time); then these pieces were laid on to fit as nearly as might be, dusted over with iodoform and covered with batting, and compresses applied. This whole proceeding took about one hour and a half from the time of the death of the old man. There were twenty-eight pieces applied in all; as it happened, too, fourteen on each limb. On the 19th of December the bandages were removed for the first time, and it was found that there was union of twenty-four of these grafts.

COCAINE HALLUCINATIONS. — MM. Magnan and Saury report three cases of hallucination due to the cocaine habit. According to the *British Medical Journal*, one patient was always scraping his tongue, and thought he was extracting from it little black worms; another made his skin raw in the endeavor to draw out cholera microbes; and a third, a physician, is perpetually looking for cocaine crystals under his skin. Two patients suffered from epileptic attacks, and a third from cramps. It is important to notice that two of these patients were persons who had resorted to cocaine in the hope of being able to cure themselves thereby of the morphine habit, — an expectation which had been disappointed. For more than a year they had daily injected from one to two grams of cocaine under the skin; without, however, giving up the morphine injections, which were only reduced in quantity. The possibility of substituting cocaine in the endeavor to cure morphinomania is a danger, therefore, which must be carefully held in view.

NOTES AND NEWS.

THE officers for the coming year of the Society for the Promotion of Agricultural Science are Professor C. E. Bessey of the University of Nebraska, for president; Professor W. R. Lazenby of Ohio University, for secretary and treasurer; and professor T. J. Burrill of Illinois University, for third member of the council.

— The thirty-third annual convention of the Association of College Presidents in New England began Nov. 7, in New Haven, Conn., at the residence of President Dwight. Delegates were present from eleven colleges, including President Eliot of Harvard, President Warren of the University of Boston, Professor Richardson of Dartmouth, President Smith of Trinity, President Carter of

Williams, President Dwight, Professors Newton and Wright of Yale, President Capen of Tufts, President Raymond of Wesleyan, President Hyde of Bowdoin, and President Andrews of Brown. The discussions were on these subjects: First, "What should be the Minimum of Mathematical Studies for the Degree of Bachelor of Arts?" Second, "Ought not our Courses of Study, both Prescribed and Elective, be so arranged that any Given Candidate for the Degree of Bachelor of Arts should be compelled to confine his Time to a Smaller Number of Subjects?" Third, "The Expediency of requiring Somewhat of Natural Science for Admission to College." Fourth, "The Means of inducing Secondary Schools to teach Science by Laboratory Methods." The convention continued through Nov. 8. Among the subjects discussed were, "The expediency of reducing the College Course to Three Years," "Limitation of Society Conventions in Term Time," "The Advantage of College Training for Teachers," and "The College Pastorate."

— Peter Graff of Worthington has announced the gift of twenty-five thousand dollars out of the estate of his son, Charles H. Graff, M.D., to endow a professorship of hygiene and physical culture in Pennsylvania College at Gettysburg. Dr. George D. Staley of Lebanon, formerly of Harrisburg, has been chosen to fill the chair.

— The leading ship-builders in England have just submitted to the Canadian Pacific Company offers for the construction of three first-class passenger-steamers for the Atlantic service in connection with the new route to the East. It will be remembered, says *Engineering*, that a week or two ago the Naval Construction and Armament Company, whose works are at Barrow, were commissioned to build three twin-screw steamers of 7,000 tons, being 440 feet long, to attain a speed of 18 knots an hour, for service between Vancouver and Yokohama, the other sea-passage of the route; the Canadian Pacific Railroad carrying the passengers from the Atlantic seaboard in Canada to the Pacific. The new Atlantic steamers will be faster than the Pacific vessels, having a maximum speed of 20 knots, with the engines indicating about 10,000 horsepower, and the boilers, of which there will be ten, working at a pressure of 165 pounds to the square inch. The intention is that the voyage from the south of England to Halifax in the winter, and Quebec in the summer, should be accomplished in at most five days and a half. Unlike the Pacific steamers, they will be propelled by a single screw, but it is quite possible that before the contract is ultimately fixed this may be altered. In the case of the Pacific steamers the first idea was to have a single screw; and, as negotiations proceeded, the builders were asked to tender for twin-screw boats, and the beam and depth of the hulls were considerably increased. The Atlantic vessels will, according to present design, be 480 feet long by 54 feet beam by 25 feet draught. The first of the new vessels, according to the mail contract with the government, must be ready to sail in February, 1891, so that the order for the steamers will likely be placed before long. It is expected that the passage from the south of England to Japan will be made in twenty-three days without any difficulty. The distance is about 9,250 miles, as against 13,750 by the Suez Canal, and 15,500 by the Cape. To Shanghai, also, the route is shorter *via* Canada, being 10,500 miles, as against 12,500 and 14,500 respectively by Suez and the Cape.

— An imperial Chinese edict, dated Aug. 27, 1889, states that "the sovereign is of opinion that to make a country powerful, railways are essential." What a wonderful change this represents in Celestial opinion since the time of the Chinese war! The great trunk line between Peking and Hankow is to be immediately commenced in two places,—in the south, from Hankow to Sin-Yang Chow; in the north, from Lu-Kow K'iao to Cheng-Ting Fu,—leaving the intervening sections for a future period. Lu-kow is five miles south of Peking. The construction of the line, according to *Engineering*, is to be under the management of Chow Fu and Taoti Pan Chün-teh, under the general superintendence of Li Hung Chang and the Admiralty. Li has transferred the whole of the foreign staff of the existing Maiping-Tientsin line to the new railway, although one of his colleagues advises that Chinese capital and labor should be relied upon solely. There is still a very strong opposition to railways in China; and the emperor, out of compassion for those who, in pulpit phraseology, may be called his "weaker

brethren," has ordered the viceroys and governors of Chihli, Hupeh, and Honan to issue explanatory proclamations, exhorting and commanding all people to throw no impediment in the way. "It is the imperial desire that all shall work together to make this great work a success." This will be the first railway openly constructed in China. The existing line commenced as a tramway from the coal-mines to a canal. Then a locomotive was put upon it, and little by little it was extended until it reached Tientsin. If the Chinese would only commence to build railways in good earnest, the effect would soon be felt in England.

— At the recent meeting of the Congress of German Men of Science and Physicians at Heidelberg, Herr O. Ammon submitted to the Anthropological Section some interesting results of observations he had made in Baden. These observations, says *Nature*, related to five thousand soldiers. The tall men had generally long skulls, or skulls of medium length, whereas the short men had round skulls. Most of the round-skulled men came from the Black Forest; the long-skulled usually belonged to the valley of the Rhine, and were especially numerous in towns and in the neighborhood of the castles of ancient families. From this fact Herr Ammon concluded that the round-skulled men had been the original inhabitants of the Rhine valley, that they had been driven from it by long-skulled invaders, and that the latter had established themselves near the settlements of their victorious leaders. Having shown that there is a certain relation between the height of the figure and the shape of the skull, Herr Ammon went on to indicate the relation between fair hair and blue eyes. No fewer than 80 per cent of the men with blue eyes had fair hair. He found also that physical growth is generally quicker in the case of the brown-eyed than in that of the blue-eyed type.

— In a paper read before the Royal Danish Academy in February, M. Adam Paulsen gave some interesting particulars of observations made with the object of determining the height of the aurora. *Nature* states that two theodolites were used, the observing telescopes of which were replaced by short tubes having small holes at the eye ends, and metallic cross-wires at the other ends. Two of the stations were situated in the same magnetic meridian, on opposite banks of the Fiord of Godthaab, at a distance apart of 5800.4 metres. The vertical circles of the two theodolites were placed in a common plane by means of observations of "blue-fire" signals given at each station. Signals were also exchanged on the appearance of an aurora which it was thought possible to measure, so that simultaneous observations were secured; and it was previously agreed to direct the instruments to the base of the auroral arc. The observations at Godthaab gave heights for different auroræ ranging from 0.6 of a kilometre to 67.8 kilometres. A second series of observations with the same apparatus and methods was made in 1885 by MM. Garde and Eberlin at Nanortalik, near Cape Farewell, the base-line in this case being 1247.8 metres; and the values determined here were 1.6 to 15.5 kilometres. The results obtained by the staff of the Swedish International Expedition at Spitzbergen, with a base of 572.6 metres, range from 0.6 to 29.2 kilometres. These observations, therefore, lead to the conclusion that auroræ are by no means confined to the highest parts of our atmosphere, but that they occur almost indifferently at all altitudes. In support of this view, M. Paulsen gives accounts of several appearances of auroræ beneath the clouds and the summits of mountains. It is interesting to compare the new values with those given by previous observers. M. Flögel calculated the heights of several auroræ which appeared in the autumn of 1870, and concluded that only the very lowest parts of the aurora came at all within the limits of our atmosphere: he gave the actual limits as 150 to 500 kilometres. For an aurora on Oct. 25, 1870, M. Reimann found a height of from 800 to 900 kilometres, and Norden-skiöld came to the conclusion that the mean height of auroræ was about 200 kilometres. On the other hand, Lemström has observed auroræ as low as 300 metres, and M. Hildebrandsson has seen auroræ in a completely clouded sky. Considering all the facts of the case, M. Paulsen inclines to believe that in the temperate zone, auroræ only appear in the higher layers of the atmosphere; whereas in the auroral zone, properly speaking, the phenomenon is generally produced in the lower layers.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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WHEN JOHNS HOPKINS UNIVERSITY was first opened, it was feared by some that it would have to depend for support on the funds left it by Johns Hopkins, and that others who might give freely to any of the older educational institutions would hesitate about aiding an institution which is so young as Johns Hopkins University, and whose prosperity is yet a credit to the memory of the founder. The events of the last few months show, however, that Johns Hopkins University has entered on a second stage in its development. It is known to all that when, on the stopping of the dividends on Baltimore and Ohio stock, it became imperative that funds be raised to supplement the income from other sources, enough admirers of the stand the university has taken among American educational institutions were found willing and able to give one hundred thousand dollars to enable the university to maintain the high grade of teaching and investigation so characteristic of it from the start. This was well enough, so far as it went; but this seems now to have been merely No. 1 in the list of generous gifts to the university this year. There followed the gift of twenty thousand dollars by Mr. Eugene Levering to the Christian Association, which has been used in erecting a building, now nearly completed. Mr. John W. McCoy gave the university, upon his death, more than one hundred thousand dollars, a magnificent library, and made the university the residuary legatee of a large estate, from which it will realize another considerable sum. The gift of twenty thousand dollars to found the Turnbull lectureship

of English poetry preceded the bequest of Mr. McCoy, and filled a long-felt want in the English department. In all, during the last six months, the university has been the recipient of more than four hundred thousand dollars, including the amount that will probably be realized from the residuum of the McCoy estate. This does not include the McCoy library.

A most satisfactory gift, as showing approval of the work done by Johns Hopkins University, is that of Mrs. Caroline Donovan, which we chronicle this week. Mrs. Donovan in her letter stated she had observed with satisfaction the work at the university, and as an evidence of her appreciation she asked the trustees to accept a gift of one hundred thousand dollars, provided that the income thereof should be used in the endowment of a chair in the university. Mayor Latrobe of Baltimore, the legal adviser of Mrs. Donovan, through whom the gift was announced to the university trustees, said, in his presentation address, "My friend, Mrs. Caroline Donovan, directs me to say in this connection, first, that she has written two letters, — one of them designating English literature, the other not naming any particular branch of instruction for which the chair is to be established. Her preference is thus shown for the study of English literature, but at the same time she does not wish to encumber the gift with this condition, and therefore leaves it to be decided by the university, she desiring to found such a chair as may be of the most practical service. From her conversations with me on the subject, I can say, however, that Mrs. Donovan would greatly prefer if the decision of the university in this connection was not for instruction in any of the so-called 'dead languages.' Second, Mrs. Donovan desires me to say that the money she gives is her own, made by herself, and not by gift or devise. Third, She also instructs me to say that before making this gift she has liberally provided for all those having any claim upon her through blood relationship or otherwise. No just complaint can therefore be made by any one, that he or she has been wronged by her thus disposing of her own money." Mrs. Donovan is the widow of William Donovan, who died several years ago. She is about eighty-six years of age, and resides in Baltimore County, a few miles from Catonsville, and is a liberal giver to many worthy charities, all of which she does secretly, in a very unostentatious manner. Her greatest fear was of having the matter mentioned in the newspapers, but Mr. Latrobe told her that it was impossible to keep any thing from them. When Mayor Latrobe suggested the gift should be called "The Caroline Donovan Chair," she objected on the ground that a chair bearing a woman's name was unusual. This succession of gifts marks the advent of a growing prosperity in the life of this university, of which all Americans are proud.

WILL SCHOOLS AND COLLEGES take advantage of the opportunities we offer them to make known, free of all cost, their needs as to additional teachers? We want to publish such items as news, and news of very great interest to many of our readers, but we find it next to impossible to rouse the school owners and managers to use what we offer. So far, in the several months that our "Want" column has been open, but one, "M. H.," has availed himself of it to advertise for a teacher. That he did so to good purpose may be judged by the following extract from his letter: "I have to thank you and your admirable paper for securing a most competent man as teacher of natural science in Ogden College. I have had, I suppose, thirty or more applications, and they are still coming." This feature has been urged on us occasionally; but, to make it of due value, there is need of a great waking-up on the part of those most interested. The backbone of any of the numerous engineering papers published in this country is the weekly list of new engineering undertakings, showing manufacturers and others where they can place their goods. The goods of some of our readers are their teaching capacities, and we hope that both

teachers of science and employers of such teachers will use the columns of this weekly to make public their needs, that they may be the better filled. We appreciate that the commercial spirit is weak in the class to which we are appealing, but it is hard to believe that it is so weak as not to lead them to write us a postal the contents of which when published may lead to an improvement in their position.

COL. M. H. CRUMP of Bowling Green, Ky., is carrying on experiments to see whether the air from the so-called Grand Avenue Cave cannot be used for regulating the temperature of a proposed hotel at that point. We have already called attention to these experiments, and Col. Crump has advertised in *Science* constantly for some weeks for information on the use of cave air for such purposes, but none of the readers of *Science* have much to offer. The scheme is novel, and the prominent geologists of the country who have been consulted have expressed considerable interest in the outcome.

THE HORN-FLY.

THE knowledge of this pest now in the possession of the division of entomology of the United States Agricultural Department is sufficiently far advanced to enable it to present a preliminary article in the last number of *Insect Life*, giving the main facts ascertained. A more complete article will be published in the annual report.

Attention was first called to this pest in September, 1887, when Mr. I. W. Nicholson of Camden, N.J., wrote to the department, under date of Sept. 22, as follows: "Herewith I send some specimens of flies which appear to have made their first appearance about the middle of August. They are very annoying to cattle, but rarely settle upon the horses or mules. They gather in patches or clusters, particularly upon the legs, and are very active. I should like to know if they are common in other parts of the United States. They appear to be very numerous in all the counties near Philadelphia, yet I have seen no person who has observed them before this season."

Later letters the same season from Mr. Nicholson mentioned the common habit of clustering upon the horns, and the fact that after a severe frost in the middle of October the fly disappeared.

May 15, 1888, the same gentleman wrote that the flies had promptly made their appearance May 10, or a little before, in great numbers. A few days later the same insect was heard of in Harford County, Md., through Mr. George R. Stephenson, who reported its occurrence in that locality the previous summer.

By the summer of 1889 the pest had extended in numbers much farther to the southward, and the department was early informed of its occurrence in Harford and Howard Counties, Md., and Prince William, Fauquier, Stafford, Culpeper, Louisa, Augusta, Buckingham, and Bedford Counties, Va. The alarm became great. Considerable time has therefore been devoted to the study of the habits and life-history of the insect. This was done mainly by Mr. Howard, who made a number of short trips to The Plains, Warrenton, and Calverton during June and July. Later in the season Mr. Marlatt assisted in the work, which had been greatly facilitated by Mr. G. M. Bastable, Mr. David Whittaker, Mr. M. M. Green, and Mr. William Johnson, and particularly by Col. Robert Beverly. Aug. 20, Mr. Howard found the flies practically in Washington, — in Georgetown, — and the next day Mr. Marlatt found them in Rosslyn, at the Virginia end of the Aqueduct Bridge, so that further trips for material were not necessary.

The result of the summer's observations by these two gentlemen is that the life-history of the insect has been accurately made out from the egg to the fly through several consecutive generations, and that substances can be recommended which, from their experience, will keep the flies away for from five to six days; while from the life-history a suggestion as to preventives is made, which, under certain circumstances, will prove undoubtedly of great benefit.

Since this insect was first brought to notice, it has been felt that it was an imported pest. Its first appearance in the neighborhood of Philadelphia, and its gradual spread southward, have favored this idea. The fact that in this country it has spread with much greater rapidity towards the south than towards the north would seem to indicate that it is a south European species.

The exact time and place of the introduction, it is impossible to ascertain. Upon its first importation in small numbers, it was probably for some time unnoticed, and its first noticeable appearance may not have been at the point of importation.

All imported cattle from Europe pass through the quarantine stations of the Agricultural Department at either Littleton, Mass., Garfield, N.J., or Patapsco, Md., and an examination of the records develops one or two points of interest. Since 1884 only ten head of cattle have been imported into the country direct from France. All of these have passed through the New Jersey station, but their ultimate destinations have in no cases been within the regions now infested with the fly. The other importations have been from points like Antwerp, London, Amsterdam, Hamburg, Glasgow, Liverpool, Southampton, Hull, Rotterdam, and Bristol. The year 1886, immediately preceding the appearance of the fly, was marked by quite an extensive importation of Holsteins from Amsterdam and Rotterdam and London, through the Garfield station, mainly for parties in New York City. Over three hundred were imported, and an interesting point to investigate will therefore be the occurrence or non-occurrence of this fly in Holland.

The popular name which is here adopted — the "horn-fly" — has the sanction of popular use. It is sufficiently distinctive. The names of "Texas fly" and "Buffalo fly" and "Buffalo gnat" are also in use in some sections, and indicate an impression that the insect came from the West. Dr. Lintner uses the term "cow-horn fly."

The most prominent of the popular errors is the belief that the fly damages the horn, eats into its substance, causes it to rot, and even lays eggs in it, which hatch into maggots and may penetrate to the brain. There is no foundation for these beliefs. As will be shown later, the flies congregate on the bases of the horns only to rest where they are not liable to be disturbed. While they are there, they are always found in the characteristic resting position. Where they have been clustering thickly on the horns, the latter become fly-specked, and appear at a little distance as though they might be damaged; and it is doubtless this fact which has given rise to the erroneous opinions cited.

Mr. Howard's first impression upon entering the field, that the eggs would be found to be laid in freshly dropped dung, proved to be correct. He brought to Washington with him from Calverton dung dropped on the night of July 28, and exposed in the field during the 29th; and from this dung the first adult flies, five in number, issued Aug. 7, only ten days from the laying of the eggs. This settled the point of place of oviposition and breeding. It seemed probable that this was the only substance in which the species breeds, as indeed it is the only likely substance which exists in sufficient quantity through the pastures to harbor the multitudes of flies which are constantly issuing through the summer. However, many living females were captured, and placed in breeding-cages with horse-dung and decaying animal and vegetable material of different kinds, each isolated; and it resulted that a few oviposited in the horse-dung, and four flies were reared from this substance. There is no evidence, however, that in a state of nature the flies will lay their eggs in any thing but cow-dung.

The time and manner of oviposition were puzzling at first. After hours of close watching of fresh dung in pastures close to grazing cattle, not a single *Hematobia* was seen to visit the dung, much less to lay an egg. This close observation was made at all times of the day from dawn till dusk without result, while breeding-cage experiments were all the time proving that nearly all fresh droppings contained many eggs. With some hesitation, therefore, the inference was made that the eggs were presumably laid at night.

The question was, however, considered by no means settled; and, on the discovery of the fly at Rosslyn, Mr. Marlatt was directed to make especial observations upon this point. The first result was, that careful examination of dung dropped in the early

morning (prior to 7 A.M.) showed very few eggs, not more than eight or ten to a single dropping, while that dropped between 4 P.M. and later in the night contained still fewer. On a dung dropped between 10 and 11.30 A.M. in the hot sunshine, however, examination a few minutes after showed a large number of eggs, estimated at three hundred and fifty. Other very fresh droppings were examined, and the eggs were found to range from none at all to over three hundred. One animal was then fortunately observed, from close quarters, in the act of passing her dung. As the operation commenced, forty or fifty of the flies moved from the flank to the back of the thigh, near the "milk mirror;" and at the close of the operation they were seen to dart instantly to the dung, and to move quickly over its surface, stopping but an instant to deposit an egg. The abdomen and ovipositor were fully extended, and the wings were held in a resting position. Most of them had left the dung at the expiration of thirty seconds, while a few still remained at the expiration of a minute. Every individual had returned to the cow, however, in little more than a minute. This explains the previous non-success in observing the act of oviposition; for the Virginia cattle on the large stock-farms are comparatively wild, and, although the dung was examined as speedily as possible after dropping, the flies had already left.

The results, therefore, indicate that the eggs are deposited during daylight, chiefly during the warmer time of the day, between 9 and 4, and mainly between 9 in the morning and noon. They are laid singly, and never in clusters, and usually on their sides on the surface of the wet dung, seldom inserted in cracks.

After the eggs hatch, the larvæ descend into the dung, remaining, however, rather near the surface. When ready to transform, the larvæ evidently descend from the dung into the ground below from a half to three-quarters of an inch. Actual observations were made on larvæ in dung in breeding-cages where the soil was fine sand, affording ready entrance to the larvæ. Where the dung has been dropped upon hard ground, the probabilities are that they will not enter so deeply, and may indeed transform upon the surface of the ground at the bottom of the dung.

From the records it appears that from ten to seventeen days, say two weeks, is about the average time from the laying of the egg to the appearance of the flies; and with four active breeding months, from May 15 to Sept. 15, there will be eight generations. The flies will undoubtedly breed later than Sept. 15, but this time may be allowed to make up for the time occupied in the development of the eggs in the abdomen of the female. With seven or eight annual generations, the numbers of the flies are not surprising.

The flies were observed in the greatest abundance during July. They make their first noticeable appearance in Virginia early in May, and, from hearsay evidence, remain until "late in the fall" or until "right cold weather." Sept. 28, they were still as abundant as ever around Washington. The characteristic habit of clustering about the base of the horn seems to exist only when the flies are quite abundant. When they average only a hundred or so to a single animal, comparatively few will be found on the horns. Moreover, as a general thing, the horn-clustering habit seems to be more predominant earlier in the season than later, although the flies may seem to be nearly as numerous. The clustering upon the horns, although it has excited considerable alarm, is not productive of the slightest harm to the animal. Careful study of the insects in the field show that they assume two characteristic positions,—one while feeding, and the other while resting. It is the resting position in which they are always found when upon the horns. In this position the wings are held nearly flat down the back, overlapping at the base, and diverging only moderately at the tip. The beak is held in a nearly horizontal position, and the legs are not widely spread. In the active sucking position, however, the wings are slightly elevated, and are held out from the body, not at right angles, but approaching it,—approximately an angle of sixty degrees from the abdomen. The legs are spread out widely; and the beak, inserted beneath the skin of the animal, is held in nearly a perpendicular position. The fly, before inserting its beak, has worked its way through the hairs close to the skin. While feeding, however, the hairs which can be seen over its body do not seem to interfere with its speedy flight when alarmed; for at a fling of the tail, or an impatient turn of the head, the flies rise instantly in

a cloud for a foot or two, returning again as quickly, and resuming their former positions.

The horns are not the only resting-places; for, with the horns black for two inches above their base, we have seen the flies towards nightfall settle in vast numbers upon the back between the head and fore-shoulders, where they can be reached by neither tail nor head. When feeding, they are found over the back and flanks, and on the legs. During a rain-storm they flock beneath the belly. When the animal is lying down, a favorite place of attack seems to be under the thigh and back belly, around the bag. With certain animals the dewlap seems to be badly attacked, while with others this portion of the body is about exempt. Certain cattle, again, will be covered with flies, and will lose condition rapidly, while others are but slightly troubled.

On the horns the flies settle thickly near the base, often forming a complete band for a distance of two inches or more. They seem to prefer the concave side to the convex side of the curve of the horn, probably for the reason that the cow cannot scrape them off so readily; and one cow was noticed in which they reached nearly to the tip of the horn on the concave side of the curve only.

The amount of damage done by the fly has been exaggerated by some, and underestimated by others. Many rumors have been heard of the death of animals from its attacks, but not a single case as yet has been substantiated. It is believed that the flies alone will never cause the death of an animal. They reduce the condition of stock to a considerable extent, and in the case of milch cows the yield of milk is reduced from one-fourth to one-half. Their bites seldom even produce sores by themselves, although a number of cases have been seen where large sores had been made by the cattle rubbing themselves against trees and fences in an endeavor to allay the irritation caused by the bites; or, in spots where they could not rub, by licking constantly with the tongue, as about the bag and on the inside of the hind-thighs. A sore once started in this way will increase with the continued irritation by the flies, and will be difficult to heal. Those who underestimate the damage believe that the flies do not suck blood; but such persons have doubtless watched the flies only upon the horns or elsewhere in their resting position, when the beak is not inserted, or have caught them and crushed them when their bodies contained little blood. In reality, the flies suck a considerable amount of blood, however, and it is their only nourishment. If captured and crushed at the right time, the most sceptical individual will be convinced.

Almost any greasy substance will keep the flies away for several days. A number of experiments were tried in the field, with the result that train-oil alone, and train-oil with a little sulphur or carbolic acid added, will keep the flies away for from five to six days, while with a small proportion of carbolic acid it will have a healing effect upon sores which may have formed. Train-oil should not cost more than from fifty to seventy-five cents per gallon, and a gallon will anoint a number of animals. Common axle-grease, costing ten cents per box, will answer nearly as well; and this substance has been extensively and successfully used by Mr. William Johnson, a large stock-dealer at Warrenton, Va. Tallow has also been used to good advantage. The practice of smearing the horns with pine or coal-tar simply repels them from these parts. Train-oil or fish-oil seems to be more lasting in its effects than any other of the substances used.

A great deal has been said during the summer concerning the merits of a proprietary substance, consisting mainly of tobacco-dust and creosote, known as "X. O. dust," and manufactured by a Baltimore firm, as an application to cattle; and it has received an indorsement from Professor J. B. Smith, entomologist to the New Jersey Experiment Station. This substance has considerable merit as an insecticide, and will kill many of the flies when it touches them, although they die slowly, and a few may recover. The substance costs twenty-five cents per pound, and is not lasting in its effects. Where it is dusted through the hair, the flies, on alighting, will not remain long enough to bite; but two days later they are again present in as great numbers as before. A spray of kerosene emulsion directed upon a cow would kill the flies quite as surely, and would be cheaper; but it is not advisable to attempt to reduce the numbers of the pest by actually killing the flies.

Throwing a spadeful of lime upon a cow-dung will destroy the larvæ which are living in it; and, as in almost every pasture there are some one or two spots where the cattle preferably congregate during the heat of the day, the dung which contains most of the larvæ will consequently be more or less together, and easy to treat at once. If the evil should increase, therefore, it will well pay a stock-raiser to start a load of lime through his field occasionally, particularly in May or June, as every larva killed then represents the death of very many flies during August. Dr. C. V. Riley feels certain that this course will be found in many cases practical and of great avail, and will often be an advantage to the pasture besides.

THE KANSAS ACADEMY OF SCIENCE.

THE annual meeting of this society was held at Wichita. Among the papers read was the following: "On Monstrosities in Flowering Plants," by W. A. Kellerman. The author illustrated what may be called extreme variations in the development of certain parts of plants. These are looked upon as interesting phenomena in botany, and deserve greater attention.

E. A. Papenoe discussed oviposition in *Tragidion*, and showed that this beetle places its egg within an elliptical case on the surface or bark of the chestnut, oak, and other trees. The egg is oblong, smooth, and dull white. The bark is not punctured, as is commonly the case with this class of beetles. Robert Hay read a paper on artesian wells, in which he showed by diagrams how such wells are possible, and what progress had been made in the West with these wells. The relation of artesian wells to irrigation in arid regions was discussed. J. T. Willard gave a brief description of devices and methods used in the analysis of agricultural products. He described a desiccating apparatus, a method of purifying ether, and a method to prevent foaming in boiling liquids. G. H. Failyer communicated the results of his work on nitric acid and ammonia in rain-water. These observations have extended through more than three years. The per cent is usually greater in smaller rains. About three pounds and a half of nitrogen are annually added to an acre of soil by the rains. But little continuous work has been done in this line in this country. F. H. Snow gave the results of his attempts at artificial spreading of contagious disease among chinch-bugs. It has been observed that a certain fungus is present where the bugs are dying in large numbers. The attempt was made to propagate this disease by sending the infected bugs to different parts of the State and to several other States. The result has been thus far successful, and the war will be pushed next season with the help of a lot of infected material which is being kept over. The same author showed the curve of mean daily temperature for twenty-one years at Lawrence, Kan. Among the interesting facts brought out, it may be noted that the average coldest day is Jan. 6; and the hottest day, July 15. There seems to be a remarkable rise in temperature during the first ten days of April, and a corresponding fall of temperature in November, thus showing a more sudden change of seasons than has been observed in some other States. Professor Snow has also made a discovery on the method of respiration of the salamander. In its final or air-breathing stage, a stream of water was observed passing into the mouth through each nostril, the mouth being opened eight or nine times a minute to allow the water to escape. Folds of mucous membrane in the posterior part of the mouth appear to perform the function of removing the oxygen from the inspired water. E. C. Murphy gave some tests of cements manufactured in Kansas. From these tests it was shown that the native cements are inferior in tensile strength, compressive strength, and transverse strength, to Portland cement. L. I. Blake gave the result of tests made in the physical laboratory on the insulation resistance of electric wires exposed to moisture. The wires were immersed in water, and daily tests were made for three months. The results were shown by a series of curves, and a remarkable difference in quality was observed. The underwriter's wire was especially condemned. The same author gave the results of experiments in telephonic communication between vessels at sea. W. S. Franklin presented a paper on classification of the sense of smell. D. B. Jennings gave the result of his observations on hot winds. Though the paper is too long to

be successfully abstracted, many interesting points were brought out. This is simply a preliminary paper on the subject.

F. O. Marvin exhibited an isogonic chart of the State of Kansas. There is shown to be an irregularity in the action of the needle in several contiguous counties. E. H. S. Bailey and E. E. Slosson presented a paper on the occurrence of celestite and associated minerals in concretionary formations in eastern Kansas. Complete analyses of the minerals will be published. E. H. S. Bailey also called the attention of the academy to the analyses of some Kansas mineral waters. Their occurrence and constituents were discussed. J. R. Mead gave a *résumé* of his observations on the occurrence of gold in Montana. L. E. Sayre gave the history and process of manufacturing binding-twine. In the discussion which followed, W. A. Kellerman suggested that perhaps some common weeds, like the velvet-leaf or the dogbane, might be used as a substitute for the more expensive fibres now in use. F. O. Marvin gave the result of a series of experiments on the second setting of cements. L. E. Sayre gave some notes on albuminoids, and also exhibited a novel and ingenious microscope attachment to be used to facilitate field-work in botany.

At the close of the meetings an excursion was made to the salt-fields of Kingman, where an opportunity was afforded to examine the practical work of salt-manufacture and salt-mining.

BOOK-REVIEWS.

Studies in Pedagogy. By THOMAS J. MORGAN. Boston, Silver, Burdett, & Co. 12°. \$1.75.

THE author of this work, who is the principal of the Rhode Island State Normal School, here gives the public a statement of the views on education to which his experience and reflection have led him. We cannot say, however, that there is much that is new or valuable in them; on the contrary, they are mostly of a commonplace order. Mr. Morgan rightly lays stress on training, or discipline, as of more importance than mere instruction; but there is nothing new in this idea, and we cannot see that he has any thing striking to offer in regard to methods of training. He lays great stress on the education of the senses and the imagination, and even proposes to have a special series of exercises for training the nose, which he characterizes as an organ of "neglected merit and overlooked modesty." He points out the importance to the teacher of a thorough knowledge of psychology, and also of a preliminary training in methods of teaching. He has a high conception of the function of the teacher, and of the qualifications necessary for their perfect performance. Mr. Morgan's views appear to us in the main sound and true; but they are so familiar that there seems to be no good reason for writing a whole volume for the purpose of setting them forth.

Seven Thousand Words often Mispronounced. By WILLIAM HENRY P. PHYFE. New York and London, Putnam. 12°. \$1.25.

THE editor of this book has produced already two books on pronunciation, — one "The School Pronouncer," and the other "How Should I Pronounce?"

That every one cares to pronounce correctly goes without saying. That every one, even if he may be reckoned among the well educated, does not necessarily know the accepted or most acceptable pronunciation of our mysteriously spelled English words, is equally true. But it is not always true that one seeking the recognized pronunciation of a word in dispute is willing to handle his big dictionary, even if he is so fortunate as to possess such; and, again, it not infrequently happens that the word may be a proper name, and proper names are sparingly treated in even the big quartos.

"Seven Thousand Words often Mispronounced" includes fully that number of words which, through inherent difficulty or carelessness on the part of the speaker, are liable to be mispronounced, with twenty-five hundred proper names.

There are the necessary introductory chapters on the sounds of the English language, — sounds both native and adopted or imported, as it were, from foreign tongues; it being the editor's idea that the adoption of so considerable a number of foreign words into

frequent use in English conversation calls for an appreciation, on the part of English speakers, of the sounds peculiar to these imported words. There are also the helps and suggestions as to the way of using the book. But the suggestion to use the book will be willingly accepted by all to whom it may be available, it is so well suited to its purpose.

The State. Elements of Historical and Practical Politics. By WOODROW WILSON. Boston, Heath. 12°.

THIS is one of the most ambitious books that we remember to have met with, but we are sorry to say that the execution is by no means adequate to the design. The work is mainly descriptive and historical, and attempts to give an account of all the more important constitutional governments on record, including those of Athens, Sparta, Rome, France, Germany, Switzerland, England, the United States, and several others. In the case of the United States, not only is the Federal Government described, but also those of the States, of the Colonies before the Revolution, and even of the counties, cities, and towns. But this is by no means all. The author has undertaken not only to describe these various governments as they now are or as they were at some particular epoch, but also to give a history of them all from the days of Homer to the present time. He has, besides, several chapters on the origin of government and on its nature and functions, on the nature and development of law, and so forth; and all this is crowded into one duodecimo volume. The necessary result is that the work is so condensed and so crammed with facts that it is almost impossible to read it through; and the broad outlines of the subjects treated are obscured by the mass of insignificant detail.

We are obliged to add that the author's conception of politics and political history seems to us defective. He confines his attention mainly to the mere machinery of government, the details of organization and administration, and has little or nothing to say on the all-important subject of the relations between the government and the people. The main question about any government is as to what rights it guarantees to the people, and how these rights are secured; but on these points Professor Wilson gives scarcely any information. His remarks, too, on the nature and functions of government are slight and superficial, and the philosophy of the book generally is very thin.

After finding so much fault, we are glad to add that the facts recorded seem to have been carefully and conscientiously collected; and, though we have not undertaken to verify them, we have no doubt they are trustworthy, and they also are pretty well arranged. The book has an elaborate table of contents, as well as an index; and it will, no doubt, be of considerable value as a book of reference, but it can hardly be used for any other purpose.

AMONG THE PUBLISHERS.

THE J. B. Lippincott Company have published a new edition, revised, of Professor Joseph P. Remington's text-book on the "Practice of Pharmacy."

— Sidney S. Rider, Providence, R.I., has in preparation for the series of Rhode Island Historical Tracts a "History of Privateering," as connected with Rhode Island during the Revolution (1776-83).

— D. Appleton & Co. have published a volume on the land question, entitled "The Land and the Community," by the Rev. S. W. Thackeray, with an introduction by Henry George; and a new edition of Bellamy's "Dr. Heidenhoff's Process."

— Beginning with the coming year, the *North American Review* will be printed on a larger page. Among the attractions of the year is announced a "Duel between Free Trade and Protection: a Great Discussion between Two Prime-Ministers, the Right Hon. W. E. Gladstone and the Hon. James G. Blaine."

— In view of the unceasing efforts for the suppression of the African slave-trade, interest will be taken in the announcement that Longmans, Green, & Co. are about to publish an authorized life of Cardinal Lavigerie, the primate of Africa, which will contain a full statement of the means by which he proposes to check this infamous traffic.

— "The Descendants of Palæolithic Man in America" is the subject of an article, by Dr. Charles C. Abbott, which will open the December *Popular Science Monthly*. It describes the surroundings and occupations of the men who made the rough pottery and the implements of slaty rock which Dr. Abbott has found so abundantly in the Delaware valley. Another of Professor C. H. Henderson's illustrated articles on "Glass-making" will appear in the same number. In this one the evolution of a glass bottle is picturesquely described. Some new phases in the Chinese problem will also be presented by Willard B. Farwell. The writer asks, in view of the wretchedness of millions of the Chinese at home, whether exclusion will exclude, and invites more thoughtful consideration of the Chinese problem, which is made especially serious by the peculiar constitution of the Chinese mind. Col. Garrick Mallery's American Association address on "Israelite and Indian" will be concluded in this number. This portion of the essay deals especially with the similarity in the myths and social institutions of the two peoples.

— One of the most accurate pictures ever given of the slums of New York will appear in *Scribner's* for December under the title "How the Other Half Lives." The author is Jacob A. Riis, for many years police reporter of the Associated Press, who has had every facility during his very active career to collect definite information on the subject. The illustrations are from flash-light photographs taken by the author. Edward J. Phelps, ex-minister to England, in his article in the same number, says, "Never since the creation has there come upon the earth such a deluge of talk as the latter half of the nineteenth century has heard. The orator is everywhere, and has all subjects for his own. The writer stayeth not his hand by day or by night. Every successive day brings forth in the English tongue more discourse than all the great speakers of the past have left behind them, and more printed matter, such as it is, than the contents of an ordinary library. . . . We certainly seem to be approaching the time when hardly any thing will be left to be said on any subject that has not been said before — perhaps many times over; when all known topics will begin to be exhausted."

— Professor Paul Haupt of the Johns Hopkins University is editing, in connection with Professor Friedrich Delitzsch of the University of Leipzig, a new periodical, *Beiträge zur Assyriologie und vergleichenden semitischen Sprachwissenschaft* ("Contributions to Assyriology and Comparative Semitic Philology"). The plan of such a series was conceived by Professor Haupt as early as 1878, but various circumstances prevented its realization. This new series will form a *pendant* to the quarto volumes of the Assyriological Library, edited by Friedrich Delitzsch and Paul Haupt, which now includes Haupt's "Akkadian and Sumerian Texts" and his "Babylonian Nimrod Epic," Bezold's "Achaemenian Inscriptions," with the Cuneiform Text of the Smaller Achaemenian Inscriptions, autographed by Professor Haupt, Strassmaier's "Alphabetical List of Assyrian and Akkadian Words," Lyon's "Sargon," Zimmern's "Babylonian Penitential Psalms," Delitzsch's "Assyrian Dictionary," Lehmann's "Samassumukin," Weisbach's "Second Species of the Achaemenian Inscriptions," and Bang's "Old Persian Texts." Due regard will be given to the principles of comparative philology, and this will be a distinctive feature of the contributions published in the *Beiträge*. Naturally the *Beiträge* will chiefly contain the work of the German Semitic School; though articles in other languages, especially in English, French, or Latin, will not be excluded. The editors do not propose to issue the journal at fixed intervals, but from time to time, as sufficient satisfactory material is at hand. Part I. of Vol. I. is now ready. Subscription and orders may be addressed to the Publication Agency of the Johns Hopkins University, Baltimore, Md.

— G. P. Putnam's Sons announce a new edition (the nineteenth) of "Haydn's Dictionary of Dates," brought down to the fall of 1889; a revised edition of Edward L. Anderson's treatise on "Modern Horsemanship;" the first volume of Charles Booth's "Labor and Life of the People," describing East London; "A History of Austro-Hungary from the Earliest Time to the Year 1889," by Louis Leger, translated from the French by Mrs. Birkbeck Hill, with a preface by Edward A. Freeman; "The First In-

ternational Railway and the Early Colonization of New England," a history of the railway system which opened Canada to the United States, together with an account of the settlement which established the English title to New England, both subjects being presented in a study of the life and writings of John Alfred Poor, edited by Laura E. Poor; "A Handbook of Precious Stones," by M. D. Rothschild; "The Sayings of Poor Richard," a collection of the wit and wisdom of Benjamin Franklin, edited by Paul Leicester Ford, in The Knickerbocker Nuggets Series; and "Thomas Jefferson's Views on Public Education," by John C. Henderson.

—J. B. Lippincott Company have in preparation George W. Childs's reminiscences, a portion of which have been given in *Lippincott's Magazine*.

—Dulau & Co., 37 Soho Square, London, W., announce to be ready early in December "A Catalogue of British Fossil Vertebrata," by Arthur Smith Woodward, F.G.S., and Charles Davies Sherborn, F.G.S. The earliest list of British fossil *Vertebrata* was published by Samuel Woodward, in his "Synoptical Table of British Organic Remains," in 1830, and occupied two pages of the volume; while thirty-five years ago the late John Morris published a "Catalogue of British Fossils," of which fifty pages were devoted to this group. The present volume will consist of about three hundred and fifty pages, and will deal with the *Vertebrata* alone, tabulating the results of researches upon the British fossil forms of this group since the time of Linnæus. In the synonymy, the latest authorities have, for the most part, been followed, though a critical study of some genera has led to the adoption of certain modifications. The nature of the type specimen in each case is stated, and, whenever traceable, the museum or collection in which it is now preserved is mentioned. The type species of each genus, when founded upon a British fossil, is also distinctly marked. In order to render the work as complete as possible, the authors have consulted the publications of all provincial societies; most of the principal collections of British fossil *Vertebrata*, both public and pri-

vate, have been visited; and it is therefore hoped that all essential references to each genus and species are included. Special attention has been given to the distribution of the pleistocene *Mammalia*, every well-authenticated locality for each species being recorded. The work will be prefaced by a general introduction, giving particulars of the principal collections available to the student, and a table of the stratigraphical distribution of the genera. The published price will be 12s. 6d.; subscriptions (if received before Dec. 1), 10s. 6d.

—The author of "An Honest Hypocrite," a theological novel in the sense that its hero is a young clergyman who is troubled with doubts and fears after he has taken orders, is the Rev. Edward Staats de Grote Tompkins, who is the rector of a church in Troy, N.Y. Mr. Tompkins is a graduate of Yale College, and is of Dutch ancestry; his family having come from Holland, and settled in Westchester County, N.Y., in 1620, which refutes the charge that the story is autobiographical. A young Englishman in New York with whom Mr. Tompkins is acquainted, and whose waverings and doubts form the basis of the plot, gave him his leading motive. The book is really the author's own beliefs put into the form of a story instead of into a sermon. The point that is at once raised by this story is, "Is Christianity a sham, or is it not?" The question is not as to its theological, historical, or liturgical truth, but as to its actual practical workings. Mr. Tompkins denies the portraits he is said to have painted. The fashionable "Dr. Grady" is not the well-known clergyman he is supposed to be, nor is "Adrienne" intended for the Duchess of Marlborough. To be sure, the Duchess of Marlborough came from Troy, where the scene of the story is laid, but the author did not know her when she was a young woman. Her character was formed before he had the pleasure of meeting her. Such, in brief, is the idea of one of the most striking novels of the day, the readers of which may be interested to know that Mr. Tompkins is a young man and unmarried.

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By EDWARD CAIRD, LL.D., Professor of Moral Philosophy in the University of Glasgow, late Fellow and Tutor of Merton College, Oxford. 2 Vols. 8vo, \$7.50.

The object of this book is to give a connected view of the Critical Philosophy, showing the relation of the three "Critiques" to each other and to the other works of Kant, which may be regarded as illustrations or developments of the main arguments. The first part, on the "Critique of Pure Reason," deals with the same subject as my former work entitled, "The Philosophy of Kant," but, except in a few passages, it is not a reproduction of it.—*Extract from Preface.*

Just Published, Volume Two, Completing Dr. McKendrick's work on Physiology.

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TIMBER AND SOME OF ITS DISEASES. By H. MARSHALL WARD, F.R.S., F.L.S. With Illustrations. 12mo, \$1.75.

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— Estes and Lauriat have published the "Salon of 1889," containing 100 photogravures of prize paintings, prepared by Goupil & Co. of Paris.

— Harper & Brothers publish "The Political Problem," by Albert Stickney, brought out by the discontent that can be observed in Europe and in this country with the practical working of existing forms of democratic government; "Winter in Algeria," written and illustrated by Frederick A. Bridgman; "A Little Journey in the World," a satire upon modern social life in America, by Charles Dudley Warner; "Cradle and Nursery," by Christine Terhune Herrick, advocating the treatment of "the baby" as a reasonable being.

— The publishing committee of the Appalachian Mountain Club announces the appearance, from the press of John Wilson & Son, of a volume with the title "Mountaineering in Colorado: the Peaks about Estes Park," by Frederick H. Chapin, one of the club's most widely known members. The book contains one hundred and sixty-eight pages. The work will be embellished with eleven full-page heliotype plates, besides other illustrations, all from photographs taken by the author upon expeditions described in the text. The work will have an interest for lovers of mountain scenery.

— P. Blakiston, Son, & Co., Philadelphia, make the important announcement of a "Chemical Technology; or, Chemistry in its Application to Arts and Manufactures," to be edited by Charles Edward Groves and William Thorp. Vol. I. is now ready, entitled "Fuel and its Applications," by E. J. Mills and F. J. Rowan, assisted by others, including Mr. F. P. Dewey of the Smithsonian Institute, Washington, D.C. This new edition of "Chemical Technology" is founded on that written by Richardson and Ronalds, and subsequently enlarged and rewritten by Richardson and Watts. As the German technology of Dr. Knapp was taken as the basis of the original, Richardson and Watts's work has long been familiarly known as "Knapp's Technology." The historical portions of the original have been retained, but supplemented by a full account of the methods and appliances introduced of late years in the application of chemistry to the arts. This work will be divided into sections, of which the most important are, "Fuel and its Applications;" "Lighting;" "Acids and Alkalies;" "Glass and Pottery;" "Metallurgy;" "Textile Fabrics;" "Leather, Paper, etc.;" "Coloring Matters and Dyes;" "Oils and Varnishes;" "Brewing and Distilling;" "Sugar, Starch, Flour, etc." The first volume treats of fuel and its applications generally; its special employment in various branches of chemical manufacture being reserved for detailed consideration in the volumes devoted to the special subjects enumerated above.

LETTERS TO THE EDITOR.

A Precocious Botanist.

ACCORDING to the "English Annals of Botany," vol. ii. p. 418, Jean Baptiste Lieurry appears to have been unusually precocious, having published a paper in 1874 on Polyporus. He was born, it is affirmed, on Dec. 14, 1888: so his researches were perpetrated fourteen years before his birth, which was subsequent to his death, that having occurred on Sept. 3, 1888. For these unusual biographical data, the editors state, they are indebted to M. Eugène Niel of Rouen. Such cases of posthumous rejuvenation are fortunately very rare in this country. C. S. M.

The Champlain Period in the Susquehanna Valley.

I HAVE lately made some observations on the drift along the river at this point, — Harrisburg, — which I wish to report. This district, being only eighty-five miles from the Terminal Moraine, was consequently much influenced by the post-glacial floods.

The stream is very shallow; and its bed, composed for five or six miles of Hudson slates, is laid bare almost every summer, offering exceptional advantages for observing the overlying drifts. The deposit consists, for the most part, of clay variously intermixed with gravel. At one point I noted a bottom layer of gravel one foot thick, overlaid by twenty feet of fine clay. Scattered through the deposit are boulders of various sizes — the largest be-

ing from six to ten tons in weight — composed of conglomerate and sandstone from the mountains beyond.

The height of the drift varies, of course, with the local topography. From one hundred feet in the mountain-gorges, to thirty feet in the lowlands opposite Harrisburg, is a fair general average.

The width of the deposit is not very great, owing to the narrowness of the valley; still it has furnished ground for most of the towns in the neighborhood, Harrisburg itself being built to a great extent on a level flood-plain thirty feet above the present water-level.

At no place in this locality has the terrace formation been noted. One level flood-plain, of equal height on both sides of the stream, is all that marks the limit of the great post-glacial river.

HARVEY B. BASHORE.

West Fairview, Penn., Nov. 7.

INDUSTRIAL NOTES.

Microscopes and Photographic Supplies.

MR. MORRIS EARLE, of the late firm of Morris Earle & Co., 1016 Chestnut Street, Philadelphia, informs his friends and former customers that he is now a member of the firm of Williams, Brown, & Earle, 33, 35, and 39 South Tenth Street, corner of Chestnut. The new firm has been appointed sole agents in the United States for Messrs. R. & J. Beck of London, the well-known manufacturers of microscopes and "Autograph" photographic lenses. In addition to the manufactures of the latter firm, there will be a complete stock of goods of foreign or domestic manufacture pertaining to the business. Mr. Earle will give his personal attention to the photographic supplies, photographic printing, and microscopical branches of the business.

Sanitary Ventilation.

ONE of the most important sanitary problems of the day is that of the adequate ventilation of our schoolrooms, factories, churches, theatres, and other buildings in which many people are gathered together for any considerable time. Even in the best of modern dwelling-houses the atmosphere is none too good, while in crowded places, such as those mentioned, the air is positively poisonous unless proper means of ventilation are employed. The air exhaled in breathing contains, besides the vapor given off by the lungs, from four to five per cent of carbonic-acid gas, at least a hundred times the normal proportion found in pure air. This gas, though not poisonous in itself, is to some extent a measure of other impurities in the air which are poisonous, and, taking the place of the oxygen, obstructs respiration by preventing that necessary gas from being absorbed by the lungs.

Careful observations and experiments show that the air of a room designed to be occupied for any length of time should not be allowed to become vitiated to an extent indicated by the presence of six or eight parts of carbonic-acid gas in ten thousand. Yet careful analyses made some years ago showed that the average atmosphere in sixty schools in this city and Boston contained, in ten thousand parts, fifteen parts, the air in one of the schools containing thirty-one parts. The mean of the air in the New York theatres had twenty-six parts of carbonic-acid gas in ten thousand, one of them being vitiated to the extent of seventy-six parts.

For healthful ventilation it has been found that different quantities of air are required under different circumstances. One authority gives as the proper quantity of fresh air per hour for each person, in ordinary hospitals, 2,400 cubic feet; epidemic hospitals, 5,000; workshops for ordinary trades, 2,100, for unhealthy trades, 3,600; halls for long meetings, 2,000; schools for youths, 1,000.

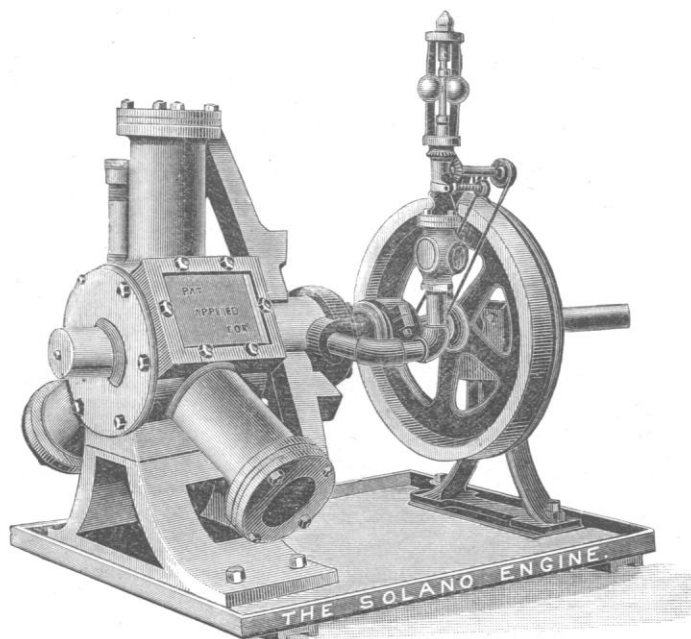
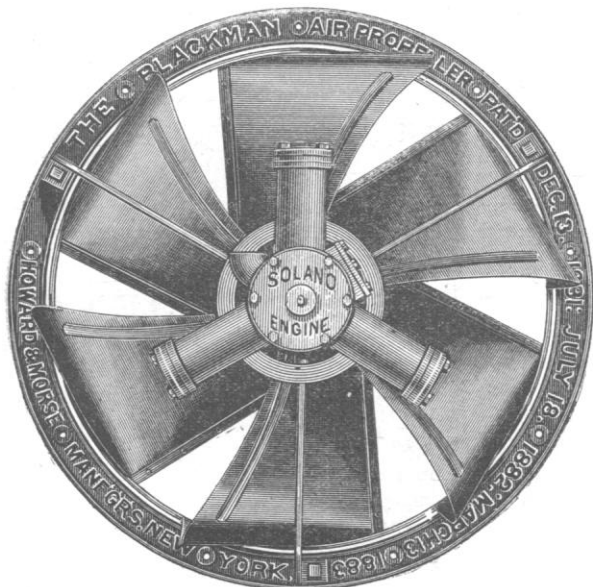
The problem of introducing this large quantity of fresh air into a building has been attacked from various directions, and with varying degrees of success. One method, much in use in this city, is that of positive ventilation, by means of a ventilator-wheel or air-propeller. One of these devices, the Blackman power ventilator-wheel, is now on exhibition at the American Institute Fair in this city, where it attracts much attention from persons interested in sanitary matters as well as from architects and builders. This wheel, and one of the means for actuating it, a high-speed steam-engine, are shown in the accompanying illustrations.

There are certain peculiar features about the Blackman wheel which entitle it to more than passing notice. It is said to be the only exhaust or blast fan made which takes in air at right angles to, as well as parallel with, its shaft, the peripheral flange increasing its supply area by about sixty-six per cent. As the amount of air removed and power required depend upon the area of the feed and delivery surfaces of air-moving machines, this wheel must necessarily give a maximum delivery with a minimum absorption

The fan, of course, may be driven by belt or electric motor, being adapted to any desired motive power.

The Merritt Type-Writer.

THE little writing-machine shown in the accompanying illustration belongs to the class of type-writers referred to in these columns last week, and known as lever or single-key machines. The paper being placed in position on the rubber roll or platen, and the latter set at the proper point for beginning a sentence, the finger-key or

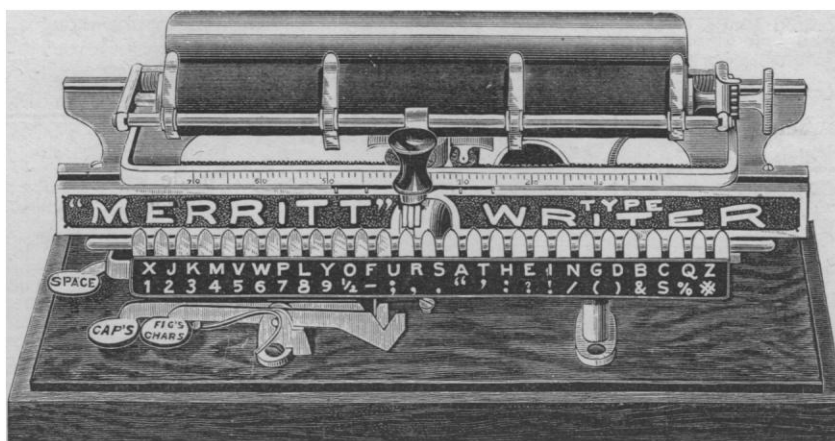


THE BLACKMAN AIR-PROPELLER AND SOLANO HIGH-SPEED STEAM-ENGINE.

of power. The actual air-propelling capacity of the wheel, as given by the manufacturers, is one million cubic feet per hour for each horse-power used. These wheels are giving satisfactory results in public halls, schools, theatres, mines, and other places, where they are used to remove vitiated air or to supply fresh air. They range in diameter from twelve inches to ten feet.

The Solano high-speed engine also possesses some features peculiar to itself. It has no dead centre, and can therefore be

lever is moved to the letter it is desired to print, and pressed down into a notch in the guide-rack. The types, which are the same as ordinary printer's types, are carried in a type-holder attached to and moved by the finger-key, and correspond in relative position with the letters on the index-plate. The movement of the finger-key to any desired letter, therefore, brings the corresponding type to the printing-point; and the depression of the key into the notch both locks the type-holder in position and forces the proper type up



started with the crank in any position; and the working parts are entirely enclosed and protected from dust. The pistons, of which there are three, are light and deep, and guide themselves in the cylinders. The valve motion is very simple, a single rotary valve being steam, exhaust, and relief valve all in one. The lubrication is entirely automatic, and, up to a speed of four hundred revolutions per minute, the only lubricator required is that on the steam-pipe, whence the oil is forced to all the parts needing it. This engine and the wheel or fan described, to the shaft of which it is attached, make a self-contained, compact, and efficient ventilating-machine.

into contact with the paper. Accurate alignment is secured by means of a type-guide.

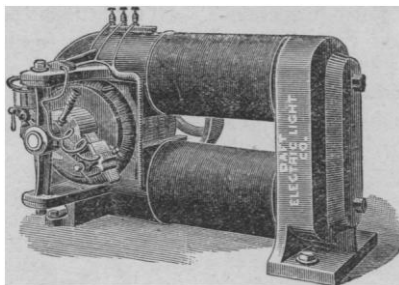
This machine prints capitals, small letters, punctuation-marks, figures, etc., and its work is as clear and legible as that of the expensive key-board machines. It uses 78 ordinary printing-types, which are inexpensive to replace when worn out. The types are inked automatically, and no ribbon is used. A speed of sixty words a minute is claimed for it; the speed-test, of course, being made by the frequent repetition of a short sentence with short words, as in all type-writer tests of the kind.

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CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

Nov. 5. — Romyon Hitchcock, The Shinto Faith; O. T. Mason, Anthropology at the Paris Exposition.

Philosophical Society, Washington.

Nov. 9. — Asaph Hall, Saturn and its Ring; C. E. Dutton, Remarks on Irrigation in the Arid Region.

Appalachian Mountain Club, Boston.

Nov. 11. — C. W. M. Black, Stony Man Mountain, the Pride of Blue Ridge; Frank O. Carpenter, The Great Smoky Mountains and Thunderhead Peak.

Engineers' Club, St. Louis.

Nov. 6. — Mr. Winthrop Bartlett presented an informal paper on the "Olive Street Cable Road." The total length is 9.6 miles. The conduit is 39 inches deep. The Johnson rail, weighing 65 pounds to the yard, is used. The speaker gave the particulars of numerous details of construction. The road was built at the rate of 274.2 feet per day, counting every day between the time of starting and finishing. Interesting information on the subject of the horse-power required under varying conditions of service was given. The enormous fluctuations of power were shown by an indicator card, in which the power varied from 136 horse-power to 609 horse-power within one minute. The percentage of power required to drive the cable only, as compared with the total power used, was about 50 per cent, much lower than on other roads. A number of practical points of experience were explained, with details of improvements that had been made. Messrs. Russell, Johnson, Seddon, and Hubbard took part in the discussion of this paper. The hour being late, it was ordered that Professor Potter's paper on "Fuel Gas" be made the special order of the next meeting, Nov. 20.

Exchanges

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Morris's "British Butterflies," Morris's "Nests and Eggs of British Birds," Bree's "Birds of Europe" (all colored plates), and other natural history, in exchange for Shakesperiana; either books, pamphlets, engravings, or cuttings. — J. D. Barnett, Box 735, Stratford, Canada.

I have *Anodonta opalina* (Weatherby), and many other species of shells from the noted Koshkonong Lake and vicinity, also from Western New York, and fossils from the Marcellus shale of New York, which I would be

glad to exchange for specimens of scientific value of any kind. I would also like to correspond with persons interested in the collection, sale, or exchange of Indian relics. — D. E. Willard, Albion Academy, Albion, Wis.

Will exchange "Princeton Review" for 1883, Hugh Miller's works on geology and other scientific works, for back numbers of "The Auk," "American Naturalist," or other scientific periodicals or books. Write. — J. M. Keck, Chardon, Ohio.

"I wish to exchange *Lepidoptera* with parties in the eastern and southern states. I will send western species for those found in other localities." — P. C. Truman, Volga, Brookings Co., Dakota.

Shells and curiosities for marine shells, curiosities or minerals address W. F. Lerch, No. 308 East Fourth St., Davenport, Iowa.

A collection of fifty unclassified shells for the best offer in bird skins; also skins of California birds for those of birds of other localities. Address Th. E. Slevin, 2413 Sacramento St., San Francisco, Cal.

I have forty varieties of birds' eggs, side blown, first class in sets, with full data, which I will exchange for books, scientific journals, shells, and curios. Write me, stating what you have to offer. — Dr. W. S. Strode, Bernadotte, Fulton County, Ill.

I want to correspond and exchange with a collector of beetles in Texas or Florida. — Wm. D. Richardson, P.O. Box 223, Fredericksburg, Virginia.

100 botanical specimens and analyses for exchange. Send list of those desired and those which can be furnished, and receive a similar list in return. Also cabinet specimens and curiosities for the same. Scientific correspondence solicited. — E. E. Bogue, Orwell, Ashta. County, O.

I will sell to chapters or individual members of the Agassiz Association, 25 fine specimens of fossil plants from the Dakota group (cretaceous), correctly named, for \$2.50. Send post-office order to Charles H. Sternberg (author "Young Fossil-Hunters"), 1033 Kentucky Street, Lawrence, Kan.



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